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105 (3358)

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BY

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No. 3358.—From the Proceedings of the United States National Museum
Vol. 105, pp. 221–317, 35 pls.

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WASHINGTON, D. C.
1956

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 105 Washington : 1956 No. 3358

BRYOZOA OF THE UNITED STATES NAVY'S 1947–1948 ANTARCTIC EXPEDITION, I–IV [1]

By Mary D. Rogick [2]

Introduction

The U. S. Navy's 1947–48 Antarctic Expedition brought back a sizable collection of Bryozoa that was turned over to the U. S. National Museum. The specimens to be discussed in these and subsequent papers of the Antarctic series are from this collection, which consists of one endoproct species and more than 100 ectoproct species, some of which are new.

Because of the large amount of interesting material in the collection it was found necessary to break up the work into a series of papers, of which the first four are contained here: I. *Barentsia discreta*; II. Family Cellariidae; III. Family Sclerodomidae; IV. Families Umbonulidae and Smittinidae.

The writer expresses deepest appreciation to the U. S. National Museum (USNM) for the loan of the collection and to the National Science Foundation for the research grant that so greatly aided these

[1] I, *Barentsia discreta*, pages 224–227 and plates 1, 2; II, Family Cellariidae, pages 228–252 and plates 3–11; III, Family Sclerodomidae, pages 253–270 and plates 12–18; IV, Families Umbonulidae and Smittinidae, pages 271–313 and plates 19–35.

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studies. Grateful acknowledgment is also made to the following: Comdr. David C. Nutt, USNR, who represented the Smithsonian Institution on the expedition and who was in charge of the biological collection; Dr. R. S. Bassler, Dr. Fenner A. Chace, Jr., and Dr. Waldo L. Schmitt, of the Smithsonian Institution, for all their efforts and for the privilege of examining the collection; to Mother M. Regis Manion of the College of New Rochelle for her aid with the formulation of Latinized names of the new species and genera; to the librarians of the American Museum of Natural History (AMNH) and the College of New Rochelle for their gracious and untiring help; and to Dr. William Beebe of the New York Zoological Society for the loan of valuable library sources.

The bryozoan specimens were collected by the U. S. Navy ships *Edisto* (AG–89) and *Burton Island* (AG–88) between Dec. 30, 1947, and Feb. 22, 1948. Commander Nutt has roughly divided the collection work into three phases and areas: first phase, Wilkes Land, Dec. 25, 1947, to Jan. 20, 1948; second phase, Ross Sea area, from Jan. 26, 1948, to Feb. 6, 1948; and third phase, Peter I Island and Marguerite Bay, Feb. 15–23, 1948. The locations of these areas are shown on plate 3.

Collecting Stations

No. 11: Lat. 66°38′ S., long. 90° E.; about 8–12 miles from Kaiser Wilhelm II coast. Bottom dredge haul 50 yds; 150 fathoms; water 29° F.; in shore ice, Dec. 30, 1947. Small vial of specimens.

No. 44: Lat. 65°25′ S., long. 101°13′ E.; 100 fathoms; water 30° F.; Jan. 14, 1948. Pint jar of specimens.

No. 45: Lat. 65°25′ S., long. 101°13′ E; bottom dredge haul 100 fathoms; water 30° F.; Jan. 14, 1948. Vial of specimens.

No. 101: Off Cape Royds, Ross Island; dredge haul; 58 fathoms; Jan. 29, 1948. Small jar of specimens.

No. 104: Off Cape Royds, Ross Island; dredge haul 58 fathoms; Jan. 29, 1948. This site yielded a large number and variety of species. Quart jar of specimens.

No. 115: Lat. 66°31′ S., long. 110°26′ E., off Knox Coast; vertical tow net haul; 100 fathoms; Jan. 19, 1948.

No. 115: Off Point 13, Lat. 66°31′ S., long. 110°26′ E.; island off Knox Coast; vertical tow net haul from bottom; 100 fathoms; Jan. 19, 1948. Two small jars of specimens.

No. 148: Peter I Island; 30 fathoms; water 29.16° F.; Feb. 15, 1948. Small jar.

No. 149: Peter I Island; bottom dredge haul "A" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. A small rock to which were attached holdfasts and colonies of Bryozoa.

No. 161: Peter I Island; bottom dredge haul "B" from 30 fathoms; water 29.6°F.; Feb. 15, 1948. Small vial.

No. 162: Peter I Island, bottom dredge haul "B" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. Small jar of specimens.

No. 163: Peter I Island; bottom dredge haul "B" from 30 fathoms; water 29.6° F.; Feb. 15, 1948. Quart jar of specimens.

No. 177: Marguerite Bay; dredge haul 115 fathoms; water 30.2° F.; Feb. 18, 1948. Small vial of specimens.

No. 180: Marguerite Bay, bottom dredge haul 85–105 fathoms; water 30.2° F.; Feb. 19, 1948. A small vial of Bryozoa and a small jar of Pterobranchiae.

No. 181: Marguerite Bay, bottom dredge haul 85–105 fathoms; water 30.2° F.; Feb. 19, 1948. A tiny box of dry specimens.

No. 184: Marguerite Bay, bottom dredge haul 85–100 fathoms; water 30.2° F.; Feb. 19, 1948. A large stone.

No. 189: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.

No. 190: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Half-pint jar of Bryozoan specimens and a small vial of Pterobranchiae.

No. 192: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.

No. 193: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.

No. 194: Marguerite Bay; bottom dredge haul from 35 fathoms; water 30° F.; Feb. 20, 1948. Small vial.

No. 225: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small vial.

No. 226: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. A small vial and a pint jar of specimens.

No. 229: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small vial.

No. 230: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Small jar.

No. 233: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Small vial.

No. 234: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F.; Feb. 22, 1948. Pint jar of specimens.

No. 236: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Small vial.

No. 238: Marguerite Bay; bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948. Half pint jar.

No. 240: Marguerite Bay; bottom stones from a bottom dredge haul from 40 fathoms; water 30° F., Feb. 22, 1948.

No. 243: Marguerite Bay; Feb. 22, 1948. A small vial of Bryozoa which had been entangled with a large starfish.

A vial marked "from Case No. 1" and 19 small stones which the author arbitrarily marked Nos. 2 to 10 and 12 to 21, inclusive, were included in the lot of specimens shipped from the Antarctic area. The collecting data on them were missing.

I. *BARENTSIA DISCRETA*

PLATES 1, 2

The only entoproct collected by the U. S. Navy's 1947–48 Antarctic Expedition was *Barentsia discreta* (Busk, 1886) from Marguerite Bay, off Palmer Peninsula, Antarctica, a new locality for the species and its southernmost record to date. The *Barentsia* specimens were unusually large and robust.

In this paper O'Donoghue's *B. robusta* and Johnston and Angel's *B. intermedia* and *B. antarctica* are considered to be synonyms of *B. discreta* and to be similar in measurements to the Marguerite Bay specimens. Ecological and distributional data from almost all the taxonomic papers on this species have been extracted and brought together here. The species has an extraordinary range in latitude and longitude, being found in Tropic, Temperate, and Frigid Zones and from the Arctic to the Antarctic, from lat. 77°53′ N. to lat. 68°30′ S. The colder water specimens are larger and more robust in almost every particular than those found in warmer waters. Measurements are given for various structures of the Marguerite Bay specimens. The Marguerite Bay specimens grew on hydroid stems and on the bryozoans *Cellarinella* and *Phylactella lyrulata*.

TAXONOMY AND MORPHOLOGY: The partial synonomy of *Barentsia discreta*, which belongs to the family Pedicellinidae, is as follows:

Ascopodaria discreta Busk 1886, p. 44.
Pedicellina australis Jullien 1888, p. 13.
Ascopodaria macropus Ehlers 1890, p. 143.
? *Barentsia misakiensis* Oka 1895, p. 81.
Barentsia timida Verrill 1900, p. 594.
Ascopodaria macropus Robertson 1900, p. 345.
Barentsia discreta Waters 1904, p. 99.
Barentsia robusta O'Donoghue 1924, p. 21.
Barentsia intermedia Johnston and Angel 1940, p. 225.
Barentsia antarctica Johnston and Angel 1940, p. 226.
Ascopodaria discreta Kluge 1946a, p. 150.

Oka's *B. misakiensis* has long been considered a synonym for *B. discreta* by most able workers, although the seeming linear regularity of the stalk pores of his figure 2 is a bit disquieting.

O'Donoghue's *B. robusta* and Johnston and Angel's *B. intermedia* and *B. antarctica* are merely variable individuals of *B. discreta*, not separate species or even new varieties. A close study of their measurements, descriptions, and illustrations does not reveal any valid or fixed character on which to retain them as new species. Their measurements fall within the range for *B. discreta*, their appearance agrees

with *B. discreta*, and their erection was based on characters which vary so much that it is my sincere opinion that *B. robusta*, *B. intermedia*, and *B. antarctica* are synonyms of *D. discreta*. *Barentsia*, as an intensive study of many living colonies of *B. laxa* showed (Rogick, 1948), can vary tremendously in length. Johnston and Angel's studies of *B. antarctica* were of necessity based on 14 stalks and 4 admittedly immature calyces, the former a very variable feature as to length and the latter not developed far enough (might even have been regenerating heads) to be of great value in determining final tentacle number.

Barentsia discreta consists of upright, stalked, calyx-topped, yellowish zoids that are connected basally with others by narrow stolons.

In side view the calyx is broadly oval, with the anterior surface shorter and more curved than the posterior surface (pl. 1, A, D). The tentacle number extremes vary from 12 (Jullien) to 29 (Harmer), depending upon the age and size of calyx. In the U. S. Navy's specimens the tentacles were badly tangled or contracted, but one calyx had 17 tentacles. On another calyx 14 tentacles were counted on one side but it was impossible to tell how many were on the opposite side. Calyx dimensions as well as other measurements are given in table 1. The calyx is deciduous and breaks off easily, but stalks may regenerate new ones, thus accounting for unusually small heads with a small number of tentacles on very long stalks, as in Johnston and Angel's *B. antarctica*.

Barentsia discreta is recognized by the peculiarity of its stalk. The stalk consists of two parts—the shorter, thick, basal musclium and the much longer, slender, pedicel-peduncle. The musclium (pl. 1,A,B) is a flexible, barrellike, muscular cylinder found in varying degrees of contraction (wrinkling or smoothness). It is topped by a thin, hard, chitinous, conical cap from which the long, slender, characteristically marked shaft continues (pl. 1,E). The shaft consists of the long rigid proximal peduncle and the short flexible distal pedicel, the two merging almost imperceptibly into each other. An incomplete septum separates the narrow peduncle from the flared cap covering the musclium. The peduncle wall has a thin outer and thicker inner cuticle (Ehlers, 1890, pl. 2, fig. 22). Small cone-shaped pits occur in scattered and irregular manner in the inner cuticle layer (pl. 1,E) and are the key character for this species. The pedicel is soft, contractile, thinner-walled, and lacks the pores or pits.

Two to five stolons lead outward from below the musclium base, the majority of them at right angles to each other (pl. 1,B). The stolons are separated from the musclium by incomplete septa and are of variable length.

The measurements for the Antarctic (Marguerite Bay) specimens (table 1) are larger for every part when compared with measurements given for *Barentsia discreta* by Busk, Harmer, Marcus (1937), Oka, Osburn (1944), and Zirpolo. They are approached closely by figures given by Verrill, and Johnston and Angel, and are exceeded in the case of total combined length of calyx and stalk only by Kluge's fine

TABLE 1.—*Dimensions, in millimeters, of parts of Antarctic* Barentsia discreta *from Marguerite Bay*

Part and dimension	*Minimum*	*Average*	*Maximum*
Musclium length	0.555	0.855	1.147
Musclium diameter	.259	.324	.407
Combined pedicel-peduncle length	3.071	4.496	5.920
Peduncle or pedicel diameter	.037	.068	.086
Calyx height	.555	.736	.925
Calyx anteroposterior length	.500	.642	.814
Pedicel, peduncle, and musclium (calyx excluded) combined length	3.848	4.910	6.475
Stolon diameter	.058	.083	.115

Arctic specimens. The total length or height of a zoid should include calyx, stalk (pedicel-peduncle), and musclium. However, because many of the Marguerite Bay specimens had either lost their heads or because some of the calyx-topped stalks were broken away from the musclium, it was not possible to get very many readings of complete, intact specimens.

On the basis of comparison of all recorded measurements for this species it can be concluded that the amount of variation in size of each individual part (calyx, stalk, musclium) is very considerable, for a bryozoan, anyway. For example, the total height or combined length of a *B. discreta* zoid (calyx, stalk, musclium) ranges from 1.584 mm. (Harmer, 1915) to 8.755 mm. (Kluge, 1946a). The very largest specimens however did come from the colder-zone waters (Arctic and Antarctic), although Verrill's Bermuda specimens were good-sized and larger than those reported from Tropical and Temperate Zones by other authors. Since this is a species found in such widely differing climatic areas and since it also occurs so near to some of our fine marine laboratories, it would be an excellent species for further ecological and physiological research.

ECOLOGY AND DISTRIBUTION: *Barentsia discreta* was taken in 1948 in bottom dredge hauls from a depth of 35 fathoms at Station 190 on Feb. 20, at Station 234 from 40 fathoms on Feb. 22, and at Station 243 on Feb. 22. Commander Nutt and Chief Electrician Layton were the actual collectors. Water temperature in the first two stations was 30° F. The *B. discreta* from Station 243 was entangled on

a large starfish. All three stations were from Marguerite Bay, an inlet of Antarctica on the west coast of Palmer Peninsula in the South Pacific between Adelaide and Alexander I Islands, lat. 68°30′ S., long. 68°30′ W. The amount of material collected at Station 190 was a half-pint jar containing about 33 different bryozoan species; the amount from Station 234 was a pint jar containing about 24 bryozoan species. Some of the *Barentsia* specimens from Station 190 grew on a bryozoan, *Phylactella lyrulata* Calvet 1909, and some of those from Station 234 grew on hydroid stems and rootlet fibers of a bryozoan, *Cellarinella*. The total amount of *Barentsia* isolated from these collections amounted to only a small vial.

Barentsia discreta presents a most interesting worldwide distribution (pl. 2). It has been reported from Tropical, Temperate and Frigid Zone waters, with the largest specimens coming from the colder waters. It grows in such diverse places as the North and South Atlantic, North and South Pacific, Arctic and Indian Oceans; the Mediterranean, South China, Caribbean, Java, and Ceram Seas; and the Gulf of Mexico, Long Island Sound, and Chesapeake Bay. Citations are given in the explanation of plate 2.

The quantity of material collected from most stations was rather small, except at San Pedro, Calif., where Robertson found it to be abundant.

The depths at which it has been reported range from 0 to 164 fathoms or from 0 to about 300 meters.

The substrates on which it grows also are diverse: the plants *Caulerpa* (Ehlers, 1890, p. 143) and *Posidonia cavolini* (Zirpolo, 1927, p. 413); the hydroid *Sertularia* (Thornely, 1924, p. 20); the gastropod *Priene cancellata* (Waters, 1904, p. 100); the parchment tubes of *Chetopterus* (annelid) (Jullien, 1888, p. 14); the bryozoans *Adeonella*, *Lepralia celleporoides*, *Retepora* (Harmer, 1915, p. 30), *Amathia alternata* (Osburn, 1932, p. 442), *Bowerbankia* (Jullien, 1888, p. 14) *Menipea* (Thornely, 1924, p. 20), and on the *Cellarinella* and *Phylactella lyrulata* of the present study. Marcus has recorded it from unidentified algae, corals, hydroids, bryozoans, shells, tunicates, and stones. The species seems to adapt itself readily to various substrates and because of its wide distribution should make an excellent form for experimentation.

II. FAMILY CELLARIIDAE

PLATES 3–11

The present study deals with the ectoproct Bryozoa of the order Gymnolaemata, suborder Cheilostomata, family Cellariidae that were collected by the Antarctic expedition.

The collection includes more than 100 ectoproct species, but only 10, belonging to the family Cellariidae, are discussed in this paper. The other species are reserved for succeeding papers.

Of the 10 cellariid species treated here, 7 are new. A new genus is created to receive three of these new species. One genus is redefined.

The measurements included in the taxonomic discussions are based on 10 readings unless otherwise specified.

Taxonomic Discussion

The family Cellariidae was erected by Thomas Hincks (1880, p. 103) to include those Cheilostomata having zooecia that are "usually rhomboidal or hexagonal, disposed in series round an imaginary axis, so as to form cylindrical shoots. Zoarium erect, calcareous, dichotomously branched." Hincks also noted the jointed condition of the colonies but doubted whether that character was sufficiently important to include in the diagnosis of the family. Canu and Bassler (1917, pp. 32–33) gave the following definition of the family Cellariidae based on the revisions and additional work of authors since Hincks.

> The whole frontal wall of the zooecia is a cryptocyst and they have a well chitinized, bilaminar, simple operculum with a straight or concave proximal margin. Within the proximal and sometimes also within the distal margin of the aperture is placed a pair of (or sometimes a single broad) supporting teeth. The subopercular area of the avicularia has an unusually strongly developed, sometimes almost complete cryptocyst. The ovicells are endotoichal. (After Levinsen, 1909.)

The expedition yielded ten species of Cellariidae, of which seven are new. These ten species are as follows:

Cellaria moniliorata, new species
Cellaria vitrimuralis, new species
Cellaria wandeli Calvet, 1909
Cellariaeforma coronata, new genus, new species
Cellariaeforma extentamuralis, new species
Cellariaeforma parvimuralis, new species
Mawsonia extensalata, new species
Mawsonia membranacea (Thornely), 1924
Melicerita latilaminata, new species
Melicerita obliqua (Thornely), 1924

Genus *Cellaria* Ellis and Solander, 1786

Harmer (1926, p. 335) characterized the genus *Cellaria* (in which he also included *Melicerita* as a synonym) as follows:

> Typically jointed, but occasionally unjointed, the zooecia usually opening all round the cylindrical internodes, which may, however, be flattened. Body cavities pear-shaped . . . produced proximally into a narrow, tubular portion, which reaches the distal part of the orifice of the preceding zooecium in the same longitudinal row. Outlines of zooecia hexagonal, pentagonal, or lozenge-shaped. Horizontal cryptocyst not definitely marked off from the lateral walls which are recumbent and usually overlap parts of the adjoining zooecia. Opesia greatly reduced, hardly larger than the orifice, the distal margin semicircular, the convex proximal border formed by a small median process, at the sides of which are a pair of condyles, sometimes accompanied by a second pair of distally situated teeth. Avicularia with undivided opesia, or with opesiules separated from it.

As Harmer stated (1926, p. 335) the genus *Cellaria* is a difficult one. Hastings (1946, pp. 233–239) cited the need for a revision and careful reexamination of the species of the genus. Livingstone (1928, pp. 39, 42) created two new genera, *Mawsonia* and *Pseudocellaria*, out of *Cellaria*. *Mawsonia* seems more justifiable as a separate genus than *Pseudocellaria*. Brown (1952, p. 164), with some hesitation, includes *Pseudocellaria* in the synonymy of *Melicerita*, a decision which appears proper. It is rather difficult to find characters which sharply differentiate *Cellaria*, *Cellariaeforma*, *Mawsonia*, and *Melicerita* from each other. The shape of the aperture and the avicularia seem to be the most usable features.

The genus *Cellaria*, in the writer's opinion, should be revised to exclude *Mawsonia*, *Melicerita*, and the new genus *Cellariaeforma*.

Emended diagnosis: Zoaria free, erect, usually jointed and usually branched. Branches cylindrical, generally dichotomous. Zooecia arranged in series of rhombi or hexagons around the branch axis, presenting a sculptured surface pattern of great beauty. Very regular areolation, which varies from rhomboidal to hexagonal. Orifice (space closed by operculum) somewhat reniform in shape and wider than long. A pair of condyles often present, one near each proximal corner of the orifice. The avicularia are vicarious and in general have a rather triangular mandible which in the majority of species is longer than wide, sometimes considerably so.

Cellaria moniliorata, new species

Plates 5,F–I; 6,A–L

Diagnosis: Colony erect, calcareous, fragile, articulated; composed of slender cylindrical internodes which arise dichotomously at the yellow chitinous joints or nodes. Articulation nodate (see Busk, 1884, pp. 85–86, and Hastings, 1946, p. 234). Transparent, punctae-covered hexagonal zooecia arranged in series of four around branch.

Zooecial walls salient, flaring outward from the centrally depressed cryptocyst area. Parenthesis-like cryptocyst ridges beaded. Zooecial orifice protruding and cellariaeform; its upper lip hemispherical and beaded, its lower lip convex and smooth. Zooecial orifice set a considerable distance away from the distal arched wall. Ovicells form a gently rounded bulge under the frontal and lateral walls of the neighboring distal zooecia. Ooeciopore slitlike, somewhat crescentic. Avicularia much smaller than zooecia, vicarious, with smaller triangluar mandible, longer than wide. The species is named for the beading on its upper lip, although other characters like the nature of the avicularia, beaded cryptocyst lines, and general appearance set it apart from other *Cellaria* species.

Colony: Some colony sprigs are about 4 cm. long and openly branched. The colony color is a translucent glassy white, with a slightly yellowish tint. The zooecia are calcareous while the nodes or joints are chitinous. The growth habit is erect, free, the branching loose and dichotomous. The slender branches which range in length from about 5 to 13 mm. are the internodes. They arise at the very short, tangled radicle nodes or joints. This condition is called nodate articulation. Zoids are arranged in successive linear series of four around the imaginary longitudinal axis of the branches. The surface face of each series fits in a zig-zag fashion into the surface face of the next series because the frontal surface of each zooecium is hexagonal. The branches are cylindrical, and zoids open out on each face of the cylinder. The cylinder is roughly either 4- or 8-sided in cross section, depending upon the level at which the cut is made. If the branch is sectioned near the midregion of a series of four zoids abreast, then the cylinder will be approximately 4-sided. If sectioned near the proximal or distal ends of a series of four zoids, the cylinder will be roughly 8-sided, because the cut is made through zig-zagging zoids of two successive series. The nonfertile branches are slender, with a diameter of 0.317 to 0.461 mm. (average 0.422 mm.). Branches bearing ovicells are a bit stouter and more bumpy than nonfertile branches. The diameter of the ovicelled branches ranges from 0.432 to 0.533 mm. (average 0.458 mm.). The branches have a slightly wavy outline in side view because the distal arches of the zoids in each series project outward more prominently than the midregions of the zoids.

Zooecia: A thin salient line encloses each zooecium. Zooecia appear superficially hexagonal, with the distal region somewhat, and the proximal region especially, coming to a sharp point and arranged in a transverse row or series of four around the branch. The projecting distal zooecial corner varies in shape from a sharply pointed, rooflike structure to a more gently pointed arch, being angular in

nonfertile and more curved in ovicelled zooecia. There is considerably more length to each zooecium than appears at the surface because the proximal part of each zoid is narrowed and considerably extended to fit neatly between and beneath the side walls of the next proximal row of zooecia. Zooecial measurements are as follows: length of external (surface) face 0.490 to 0.662 mm. (average 0.619 mm.); width of external surface face 0.230 to 0.317 mm. (average 0.281 mm.); genuine over-all, internal and external length of zooecia 0.835 to 1.181 mm. (average 1.094 mm.).

The zooecial frontal surface, a cryptocyst, is pebbled or covered with small, well spaced bumps. The cryptocyst is somewhat pan-shaped, the central frontal area depressed or flattened while the side walls arise upward and outward at an angle (pl. 6,C). The walls also are pebbled. Two conspicuous, beaded ridges, curved like parentheses, arise from the frontal (CR in pl. 6,B). They begin in the arched or gabled distal walls, at each side and above the zooecial orifice, then curve convexly along the frontal surface, near each lateral wall, but do not meet proximally. These cryptocyst ridges are present on the frontal of this species as well as the inconspicuous delicate smaller parenthesis-shaped chitinous rods or trabeculae which Busk (1884) cites as occurring at the two sides of the operculum in some other species (pl. 5,H).

ZOOECIAL ORIFICE: The orifice through which the tentacles are extruded and which is closed by an operculum is of typical *Cellaria* form, arched in a semicircle distally, broadly and slightly concave proximally, with two teeth or condyles, one in each corner (pl. 5,H). The upper lip or distal arch presents a hooded and beaded appearance (pl. 6,L). The lower lip is smooth and protruded as in a pout. The whole orifice is raised above the cryptocyst frontal area like a dormer window (pl. 6,D). The arched distal walls of the zoid meet rooflike above the projecting orifice (pl. 6,H). The orifice is closed by a smooth chitinous operculum which is lightly reinforced around the edge (OP in pl. 6,C). Orifice length varies from 0.038 to 0.054 mm. (average 0.048 mm.) in midline and the width ranges from 0.115 to 0.130 mm. (average 0.121 mm.). Its total, over-all, boxed-in length varies from 0.058 to 0.072 mm. (average 0.063 mm.).

OVICELLS. The ovicells (OV in pl. 6,B) are endotoichal with distal end slightly truncate. They form low mounds, longer than wide, around the branch (pl. 6,A). Their length is from 0.187 to 0.259 mm. (average 0.232 mm.). Their width is from 0.187 to 0.216 mm. (average 0.197 mm.). They are buried under the flaring walls of the three adjacent zoids (the two lateral and the parent-proximal zoids). These walls meet in a thin salient line, like an inverted

Y or T over the ovicell front (MR in pl. 6,B). A transverse banana-shaped ooeciopore (pl. 6,B) opens into the ovicell. The ooeciopore length from 0.014 to 0.029 mm. (average 0.023 mm.); width from 0.086 to 0.101 mm. (average 0.097 mm.). There is a sizable strip of cryptocyst between the ooeciopore and the zooecial orifice. The zooecial walls which meet over the front of the ovicell are beaded or pebbled. There are no pores in the frontal of the zoids or in the ovicell frontal.

AVICULARIA: The avicularia are few, vicarious, smaller than the regular zoids (autozoids), and placed longitudinally above the distal arch of a zooecium between the side walls of the two zooecia of the next series (pl. 6,D–F). Their shape varies somewhat from spindle to pentagonal, with length greater than width. Their over-all dimensions are: length from 0.187 to 0.317 mm. (average 0.236 mm.); width 0.101 to 0.173 mm. (average 0.127 mm.). They are bordered by a salient line. The avicularial beak is acutely triangular and raised at the distal tip. Its opening or opesia is pointed distally and is set off from the proximal hemispherical space on each side by a toothlike ledge. The mandible is an elongate triangle (pl. 6,K). The avicularium does not replace a zooecium in a series but is inserted between them (pl. 6,D). The proximal avicularial surface is beaded or pebbled (pl. 6,E).

RADICLES: Radicles are transparent, yellow chitinous tubes arising either freely from the front of the zoids or located in a tangled mass at the joints. The former are long, slender, single or double tubules which spring out from the front of the zooecium, through the cryptocyst, below the zooecial orifice and pass downward to form rootlets or holdfasts near the base of the colony (pl. 6,I,J). They begin to branch tortuously a short distance from the zoid front. The second group of radicles, those located at the joints or nodes, form a compact tangled yellow mass at the point of dichotomous bifurcation of a branch. They sprout from the zooecia at the node (pl. 5,I).

TYPES: Holotype, USNM 11210; paratypes, USNM 11211.

ECOLOGY: Other forms may grow on this *Cellaria*—namely, Foraminifera and Bryozoa like *Cellepora* and *Hippothoa distans*. Its rootlets or radicles may adhere to other Bryozoa. *Cellaria moniliorata* was collected at Antarctic Stations 104 and 115. The amount of material collected was a small vial containing numerous colony fragments.

Cellaria vitrimuralis, new species

PLATES 4; 5,A–E

DIAGNOSIS: Colony erect, calcareous, fragile but more robust than *Cellaria moniliorata*, articulated, composed of slender internodes which

arise dichotomously at the yellow chitinous nodes. Articulation tubulate (see Busk, 1884, pp. 85–86; Hastings, 1946, p. 234). Crystal-clear smooth thin-walled zooecia arranged in transverse series of five around the branch. Sometimes tiny tubercles occur on the cryptocyst, set far apart. Zooecial walls salient, ribbonlike. Fertile zooecia nearly rhombic, nonfertile ones hexagonal. Zooecial orifice cellariaeform, very close to the distal arch of the zooecial wall. Its distal or upper lip is hemispherical; lower lip faintly convex, with a condyle at each proximal corner. Parenthesis-like chitinous rods at side of zooecial orifice and also faint thin cryptocyst ridges present. Ovicells broadly truncate distally, roughly quadrangular in front view. Ooeciopore oval or ellipsoidal. Avicularia vicarious, as large as the autozoids which they replace in the transverse series. Mandible large, triangular. The species is named for the transparent crystallike beauty of its walls.

Colony: The colony color is a translucent glassy white with a slight yellow tint. Zooecia lightly calcified, nodes chitinous but covered for a time at least by the calcareous zooecial bases (pl. 5,E). The growth habit is like that of *Cellaria moniliorata*, free, erect, with branching loose and dichotomous (pl. 4,D). The slender branches range in length from 7 to 14 mm. Some colony fragments are 56 mm. long but that is only part of the possible colony length. Articulation is tubulate, a condition where the internal chitinous joints are straight, yellow to amber colored tubes or cores covered by zooecial walls and where the cluster of tangled radicle fibers is absent (pl. 5,E).

Zooecia are arranged in successive linear transverse series of five around the imaginary longitudinal axis of the branch (pl. 4,F,I). Occasionally a branch will have a series of four zooecia but the 5-zooecia series is the rule. Successive series fit into each other in zig-zag fashion so that if a transverse cut is made through a branch in a midseries region the branch is 5-sided, but if made in the zig-zag region the branch is 10-sided (pl. 4,F,I). A zoid opens out on each face. Branches are quite uniform in diameter throughout their extent and everywhere in the colony, ranging in thickness from 0.590 to 0.742 mm. (average 0.667 mm.). Even fertile, ovicelled branches do not seem very much larger in diameter than nonfertile ones (compare figures H and J of pl. 4). Areolation is nearly rhombic in fertile branches but very regularly hexagonal in nonfertile branches (pl. 4,I,J).

Zooecia: The surface faces of zooecia in nonfertile branches are sharply hexagonal, with clear-cut razor-edge outlines (pl. 4,I). They are longer than wide. The fertile zoids, because of the ovicells which are buried under the side and front walls of neighboring zoids, assume a more nearly rhombic or diamond shape in frontal aspect (pl. 5,A).

Measurements of the external, visible frontal surface of nonfertile zooecia are: length from 0.677 to 0.936 mm. (average 0.788 mm.); width 0.288 to 0.461 mm. (average 0.366 mm.). Measurements for actual zooecial length are much greater (0.864 to 1.44 mm., average 1.076 mm.) because so much of the proximal part of a zooecium is hidden beneath and between the side-front walls of neighboring zooecia. Zooecial walls are of crystal clarity, smooth and shiny (pl. 5,A). Zooecial outlines are sometimes marked by a sizable salient razor-thin lamella (w in pl. 5,A) which looks like a glass partition. Occasional twigs may have a few tiny tubercles or bumps, very far apart. Cryptocyst ridges are nearly straight, thin, barely noticeable in this species. They are shown in plate 4,I in nearly all zooecia. They converge proximally but they do not meet. There also occur delicate, short, inconspicuous parentheses around the zooecial orifice (pl. 4,C,H). These are called chitinous rods by Busk.

Zooecial orifice: The orifice is set very close to the distal arch of the zoid wall and its dimensions are: length from 0.086 to 0.115 mm. (average 0.098 mm.); width 0.144 to 0.173 mm. (average 0.163 mm.). It is hemispherical; its proximal border is very faintly concave (pl. 4,C). There are two small conical condyles, one at each proximal corner. A small shallow sinus also is at each corner. An operculum fits very snugly into the orifice and its outline is the same as that of the orifice (pr in pl. 4,H; pl. 5,B–D). The operculum is smooth and nearly flat on the external side. From its hemispherical rim a broad flange extends inward (f in pl. 5,D). To the two lateral sides of the flange are attached two calcified scapula-shaped plates containing fiber bundles, giving the operculum the appearance of a drawbridge (pl. 5,B, and mp in pl. 5,D).

Ovicells: The ovicells are endotoichal, with truncated ends and gently curving sides, giving them a somewhat rectangular appearance (ov in pls. 4,J and 5,A). Their dimensions are: length from 0.259 to 0.360 mm. (average 0.310 mm.); width 0.230 to 0.288 mm. (average 0.261 mm.). The ovicell opens to the outside by an elliptical ooeciopore (op in pl. 4,J), which is from 0.043 to 0.065 mm. (average 0.054 mm.) long and from 0.058 to 0.115 mm. (average 0.096 mm.) wide. The ooeciopore is located very close to the distal lip of the zooecial orifice, much closer than in *Cellaria moniliorata*. The side and frontal walls of the three neighboring zoids cover the frontal surface of the ovicell, meeting in a salient X suture on the ovicell (pl. 4,J).

Avicularia: The avicularia (pl. 4,A,B,E) are vicarious, about the size of the autozoids. They are from 0.734 to 0.922 mm. (average

0.805 mm.) long and 0.230 to 0.389 mm. (average 0.333 mm.) wide. They may occur singly or in 2's or 3's on a stalk in the same series. Their raised subtriangular beaks point distally and are raised in the form of an inverted V at the distal half or third of the avicularium (R in pl. 4,A). The greater part of the avicularial opening or opesia is covered by a triangular mandible. The dimensions of this triangular space are: length from 0.374 to 0.418 mm. (average 0.389 mm.); width 0.130 to 0.173 mm.(average 0.154 mm.). This triangular space is set off from the lower sunken hemispherical proximal opening by the two conspicuous ledge-like condyles (pl. 4,A, and L in pl. 4,B) on which the mandible articulates. This proximal hemispherical part is called the "area" in Canu and Bassler's works (1920, p. 62) and is depressed in *Cellaria vitrimuralis*.

The elongate, subtriangular mandible is directed distally. Its dimensions, based on only three readings, are: length from 0.158 to 0.346 mm. (average 0.300 mm.); width 0.202 to 0.216 mm. (average 0.206 mm.). Its edge is chitin-reinforced. There is a thinner, more transparent large central area in the mandible. From the basal corners of the mandible two converging chitinous bars or sclerites (S in pl. 4,B) encroach upon this central area. There is a prominent sharp tooth or spike turned inward from the mandible apex (pl. 4,G). From the center of the basal bar, which marks the broad end of the mandible, projects inward a small curved process. Two bundles of muscle fibers attach above this basal median process, one on each side (pl. 4,A, and U in pl. 4,B).

The avicularia take the place of the regular zoids in a series (pl. 4,H).

Radicles: Extremely thin-walled, transparent, pale yellow tubules exit through the frontal wall of some of the zoids (pl. 4,I). These radicles are often quite long. Their diameters increase until they become one-half to three-fourths the diameter of the zooecial branches. They are directed proximally. Joints or nodes are more deeply colored (deep yellow to amber) than are the frontal radicles (pl. 5,E). The nodes seem to be part of the inner zooecial wall and are straight. No tangle of radicle fibers occurs at the joints between branches in this species.

Types: Holotype, USNM 11213; paratypes, USNM 11214.

Ecology: The branches of *Cellaria vitrimuralis* were generally free of overgrowing organisms, but occasionally Foraminifera, cyclostomatous Bryozoa and *Hippothoa* would be found attached to them. *Cellaria vitrimuralis* was collected at Antarctic Station 104. The amount of material available for study was a very small jar which contained numerous colony fragments.

Cellaria wandeli Calvet

PLATE 7,A,B

Cellaria wandeli Calvet, 1909, p. 23, pl. 2, figs. 3–6.

TAXONOMY: This species fits most uncomfortably in this genus, yet there seems to be no other place to rightly put it, at the moment. Its avicularia are similar to those of the genus *Cellaria* but its orifice and operculum are a bit distorted and do not quite fit the generic description, being longer than wide and somewhat more like those of *Mawsonia*.

COLONY: The material consists of seven tiny, ivory colored fragments, not one of them more than 7 mm. long. They are calcareous, cylindrical, slender, ranging in diameter from 0.648 to 0.885 mm. (average 0.754 mm.). Areolation appears to be mostly rhomboid. Zoids are 4–6-sided. The number of zoids in a transverse series around the imaginary longitudinal axis of the stalk appears to be five. In Calvet's original description of this species there was no mention of the number of zoids in a series nor were any measurements given. Calvet's excellent illustrations (1909, pl. 2, fig. 3) were of a young colony whereas the figures shown here are of older individuals.

ZOOECIA: The zooecia are longer than wide. Their length ranges from 0.734 to 0.850 mm. (average 0.785 mm.); their width from 0.302 to 0.389 mm. (average 0.347 mm.). The few fragments of the present collection contained zoids which were mostly rhombic. The zooecial corners are quite pointed. The walls fuse together externally to form a thin, knife-like edge which is a bit jagged or rough. The walls are slightly crinkled or marked with faint vertical grooves. The walls are salient, tall, flared like the sides of a pan from the flattened depressed frontal surface. The zooecial frontal is flattened except for the orifice which is salient. Cryptocyst ridges and chitinous parentheses rods were absent from these specimens.

ZOOECIAL ORIFICE: The zooecial orifices are longer than wide, measuring 0.130 to 0.151 mm. (average 0.138 mm.) in length and 0.086 to 0.115 mm. (average 0.102 mm.) in width. They are wider proximally than distally. The distal end is curved convexly. The two lateral sides pinch in slightly in their midsection, then diverge proximally. The lower lip is narrow, spoutlike, salient. On each side of it is a deep sinus. Back of the sinuses, within the orifice, are two condyles for the articulation of the operculum. The cryptocyst just beneath the proximal lip is depressed. The operculum was not seen.

OVICELLS: The ovicells are not raised above the margin of the zooecia. Only one ovicell has a well curved, crescentic opening (all the other ovicell openings are rounded), whether incomplete or eroded

could not be ascertained. Measurements of the rounded openings are: length 0.058 to 0.144 mm. (average 0.103 mm.) and width 0.058 to 0.101 mm. (average 0.084 mm.). Calvet's specimens (1909, pl. 2, fig. 3) had crescent-shaped ovicell openings but he stated (1909, p. 24) that the concavity becomes almost rectilinear, thus somewhat approximating the condition of the U. S. Navy expedition's specimens. The ovicells are located between the zooecial orifice and the distal arch of the zooecial wall.

Avicularia: The avicularia are set at a slight slant at the proximal border of a zooecium. Their dimensions are: greater diameter (length) 0.216 to 0.22 mm. (average 0.26 mm.); lesser diameter 0.158 to 0.202 mm. (average 0.177 mm.). The beak is directed diagonally with respect to the longitudinal axis of the zooecia. Mandibles were not seen.

Distribution: Specimens were collected at Antarctic Station No. 44 from a depth of 100 fathoms. Calvet reported the species from Booth-Wandel Isle at a depth of 40 fathoms. He pictured it accurately but gave no measurements for it.

Genus *Cellariaeforma*, new genus

Diagnosis: Colony erect, free, cylindrical, calcareous. No colony fragments were long enough to indicate if the colony was capable of branching and in what manner. Zooecia arranged in transverse series around the imaginary longitudinal axis of the stalk. Zooecia of considerable length, the proximal part always hidden beneath and between the side walls of neighboring proximal zoids. Areolation rhombic to hexagonal. Zooecial orifice slightly salient, wider than long, angular, distal border and lateral walls straight, proximal border concave. Two proximal condyles and two distal teeth in orifice. Space between distal rim of orifice and distal arch or cornice of zooecial wall considerable. Avicularia small, vicarious, resembling those of *Melicerita* more than those of *Cellaria*. Avicularian mandible wider than long and with a broadly curved border.

The genus name indicates its very close resemblance to *Cellaria*.

The genotype of the new genus is *Cellariaeforma parvimuralis*.

Cellariaeforma coronata, new species

Plate 8,C

Diagnosis: Characters like those of the genus plus the following ones. Zooecia arranged in transverse series of four or five around the imaginary longitudinal axis of the stalk. Areolation hexagonal. Visible zooecial side walls obliquely flared. Cryptocyst sometimes tuberculate. Prominent cryptocyst ridges meet to enclose a large frontal area, like a garland around a neck, hence the species

name. Conspicuous parenthesis-shaped chitinous rods enclose the orifice. Zooecial orifice slightly salient. Operculum covers even the orifice rim amply. Two small diagonal sclerites present on the operculum. No avicularia were seen. Description is based on only one branch of a colony.

Colony: Only a single small cylindrical fragment of the basal part of a colony was available. It is about 1 mm. thick and 14 mm. long. The ivory-colored sprig terminates in a tangle of chitinous radicle fibers which arise from the calcareous zooecia near the base. The areolation is hexagonal, but an occasional zooecium seems rhombic. Zoids occur in a transverse series of four or five around the long axis of the branch.

Zooecia: The zooecia are longer than wide; their proximal ends are well hidden beneath and between the side walls of the neighboring proximal zoids. The visible surface area is shorter than the actual zooecial length as is true for all the species of this genus. The measurements for this visible frontal surface of the zooecium are: length from 0.547 to 0.720 mm. (average 0.667 mm.); width 0.418 to 0.461 mm. (average 0.439 mm.). The zooecia are hexagonal but an occasional one is rhombic. Their distal arches or cornices are not sharply pointed but arched gently. The side walls or zooecial mural rims are raised, thin, and slanted from vertically to obliquely. In some places delicate lines or creases appear in the walls, as if due to a series of low tubercles arranged in rows or due to the irregularities in calcification of the walls. A delicate, flat, parchmentlike membrane covers some of the zooecia, obscuring their skeletal characteristics. The cryptocyst in some zooecia is smooth, in others covered with small, irregular, somewhat closely placed tubercles, giving it a gently pebbled appearance. Scarcely noticeable tubercles sometimes are so lined up along the flaring side walls that the latter may have a faintly crinkled or lined aspect. Other decorations of the zooecial frontal include the very pronounced chitinous rods parenthesizing the orifice on the parchment membrane, and the cryptocyst ridge. The latter varies in completeness in the different zoids but eventually assumes a horseshoe shape or gives the impression of a garland around the orifice. Its distal edges begin near the lateral walls of the orifice.

Zooecial orifice: Because opercula are present the shape of the orifice is somewhat obscured. The opercula appear very slightly larger than the orifices and measure from 0.094 to 0.122 mm. (average 0.108 mm.) in length and from 0.122 to 0.144 mm. (average 0.137 mm.) in width. They are chitinous and have a faintly roughened or pebbled appearance. None was dissected away to reveal the orifice or for detailed study because of fear of damaging the lone sprig of

material. The distal edge of the operculum is nearly straight to gently convex, the two lateral sides are nearly parallel and the proximal border is slightly concave. Two short, obliquely set sclerites are placed a short distance from the lateral walls. The operculum seems to have a chitinous flange that fits inside the orifice.

The orifice itself seems to be very much like that of the other species in this genus. It is nearly straight distally, its two lateral sides are almost parallel, and its proximal border is concave and bordered by a curved lip. The two proximal condyles are visible sometimes through the operculum. The distal teeth may be present although they were not clearly seen. The orifice of this species is not raised quite as much from the frontal zooecial surface as are those of other species in this genus. The orifice is located about its own length away from the distal arch or cornice.

Ovicells: The ovicells are placed between the orifice and the distal cornice, occupying the whole area and sometimes extending beyond but under the cornice, to fit partly between and beneath the side walls of the distal zoids. The ovicell shapes vary from a very broad oval to a rounded-corner triangle. The exposed ovicell wall in some cases is tubercled, as is the cryptocyst. The side walls of the ovicell begin at the distal corners of the zooecial orifice, meeting the ends of the cryptocyst ridges. The ovicell side walls are salient but not highly so. They meet the extended corners of the side walls of the zoid to form the distal cornice of the individual. The dimensions of the ovicells are: length from 0.101 to 0.137 mm. (average 0.115 mm.); width 0.173 to 0.202 mm. (average 0.179 mm.).

Avicularia: None was seen on the small sprig.

Radicles: The chitinous rootlets sprout from the midfrontal face as in the other species of this genus, and grow in a downward (proximal) direction, toward the base of the colony. Their diameter is 0.050 to 0.072 mm. (average 0.067 mm.).

Type: Holotype, USNM 11219.

Ecology: This species occurred at Antarctic Station 104. No other species of animals were growing on the single sprig.

Cellariaeforma extentamuralis, new species

Plates 7,I; 8,A,B

Diagnosis: Characters same as those of the genus, plus the following features. Areolation and external faces of the zooecia rhombic to hexagonal. Areolation heavy, coarse, visible to the naked eye. Zooecia arranged in transverse series of six or seven around the longitudinal axis of the branch. Cryptocyst not tuberculate. Zooecial side walls flare outward obliquely very conspicuously above the general

level of the zooecial front and are marked with faint lines. Lateral sides of the zooecial orifice straight and nearly parallel. The species is named mostly for this conspicuous flaring of the walls, although that feature is present to some extent in a few other species.

Colony: There are only nine small ivory-colored scraps, none continuous and none more than 12.5 mm. long, so a complete colony was not available for study. The pieces are slender, rod-shaped, 0.696 to 1.253 mm. (average 1.032 mm.) in diameter. The areolation is rhombic to hexagonal and evident even to the naked eye. The surface of the colony is marked like a fine file by the raised zooecial walls.

Zooecia: The external visible frontal surface of the zooecia measures 0.648 to 0.835 mm. (average 0.747 mm.) in length and 0.403 to 0.576 mm. (average 0.504 mm.) in width. The zooecia are rhombic to hexagonal and shaped somewhat like an angular pan; the frontal cryptocyst is depressed except for a slightly salient orifice, the ovicell walls, and the zooecial walls. The zooecial walls flare conspicuously and somewhat obliquely outward, framing the frontal area. The mural rims of neighboring zoids meet and fuse in a raised knife-edge. Faint transverse lines or creases give the mural rims a delicately crinkled appearance. These creases appear to be due partly to small irregularities in the thickness of calcification and also sometimes to a few small, very low tubercles lined up transversely. The mural rims are crumbly, jagged or uneven. The zooecial wall is quite opaque. Some of the specimens were a bit difficult to study because of fine chalky accumulations on their surface, as if covered lightly by debris. Also, some of the sprigs appear a bit eroded as if some chemical had affected the calcareous surface.

Zooecial orifice: The dimensions of the zooecial orifice are: length from 0.101 to 0.130 mm. (average 0.120 mm.); width 0.158 to 0.187 mm. (average 0.173 mm.). The zooecial orifice is raised sharply from the frontal. Its distal border is straight. The lateral walls are straight and nearly parallel. The proximal border is concave because of the convex curvature of the lower lip. Two prominent condyles project into the orifice near the proximal corners. Opposite them, from a ledge located inside the distal rim of the orifice, are two distal triangular or broadly pointed teeth. These arise from a prolongation of the two corners of the calcareous ledge. The ledge does not reach the lateral walls. The proximal teeth also are borne on a ledge which is part of the lower lip. No opercula were seen.

Ovicells: All the ovicells seen are imperfect, as if the front had been broken away at least in part, leaving only the ovicell cavity. This cavity measures 0.173 to 0.202 mm. (average 0.180 mm.) in

length and 0.158 to 0.216 mm. (average 0.185 mm.) in width, and is broadly oval in outline. Part of the ovicell cavity remains hidden beneath and between the side walls of the neighboring distal zooecia. Since no soft parts were found on the zooecia and ovicells it could not be determined with certainty if the front of the ovicell was calcareous or membranous.

Avicularia: Only a few avicularia were seen and none with mandibles in place. They are small, vicarious, and resemble those of *Cellariaeforma parvimuralis*. The few seen are broadly spindle-shaped to pentagonal, obliquely placed near the distal end of a zooecium. The avicularia measure from 0.274 to 0.288 mm. (average 0.285 mm.) along the longer diameter and from 0.187 to 0.216 mm. (average 0.196 mm.) along the shorter diameter.

Types: Holotype, USNM 11245; paratypes, USNM 11246.

Ecology: The specimens came from Antarctic Stations 44 and 45. No other organisms grew on the colony scraps.

Cellariaeforma parvimuralis, new species

Plate 7,C–H

Diagnosis: Characters as in the genus, plus the following. Zooecia in transverse rows of five or six around the longitudinal axis of the branch. Areolation usually rhombic, occasionally tends toward hexagonal. Zooecial orifice very angular, lateral sides diverging proximally. Zooecial frontal surface flattened, the side walls very thin and slightly salient. The cryptocyst is closely tubercled. Pronounced cryptocyst ridges and parenthesis lines around the orifice lacking, although some do show very faint cryptocyst elevations, which are deeply curved, parenthesis-like. Zooecial walls quite opaque. The species is so named because of its small, not very high, walls.

Colony: There are only seven small fragments of this ivory-colored species available. Not one of these is a complete colony. Three erect stalks are held together at the base by a cluster of yellow chitinous rootlets. Although no joints are present in the fragments it is quite possible that the mature or full-length colonies might be jointed. The stalks are cylindrical. Their diameters range from 0.792 to 1.138 mm. (average 0.959 mm.). The longest fragment is 13 mm. Zooecia occur in transverse series of five or six around the longitudinal axis of a branch. Areolation is rhomboidal, with rhombi with some tendency toward hexagonal in some areas.

Zooecia: Most of the zooecia are rhombic or diamond shaped but some are 5- or 6-sided, with one or two of the sides very short. The corners are generally sharp, the distal arch a bit more curved than the

other corners. The visible frontal surface of the zooecia measures 0.662 to 0.806 mm. (average 0.752 mm.) in length and 0.518 to 0.576 mm. (average 0.552 mm.) in width. The zooecial surface is quite flat except for the salient zooecial orifice and the very thin, slightly raised, low side walls. The two most depressed areas of the zoids are the ovicell and the space just below the lower lip. The cryptocyst covering the front of the zoid is tubercled but the tubercles, though numerous and quite close together, are small so that the front still appears flat, though of a pebbled texture. Many zooecia do not seem to have cryptocyst ridges but some do show faintly raised parentheses-like ridges which begin at the sides of the orifice, near the ovicell walls. The zooecial walls are quite opaque and the hidden underlying parts of the zooecia could not be made out accurately.

Zooecial orifice: The angular orifice is slightly salient. It is from 0.086 to 0.115 mm. (average 0.105 mm.) long and from 0.173 to 0.187 mm. (average 0.183 mm.) wide, and is placed about three-tenths of the zooecial length from the distal edge of the zoid, leaving a wide strip of cryptocyst between it and the distal wall arch. The external, distal border of the orifice is straight, as are the two lateral walls which diverge somewhat proximally. The lower lip is curved to give the orifice a concave outline. Two conspicuous conical condyles are located at the proximal corners. Two smaller condyles or processes are beneath the distal lip. These distal processes are not teeth but are prolonged corners of a calcareous plate or ledge which hangs down into the orifice. The lower border of this plate is concave, the two corners prolonged to form the so-called teeth. The operculum fits the orifice snugly. It is angular, yellow, and chitinous, with distal edge straight, distal corners gently curved, and lateral sides diverging slightly proximally. Its proximal border is concave and its rim is reinforced with chitin.

Ovicells: These are located largely between the distal lip of the zooecial orifice and the distal zooecial arch. They are basinlike. Whether they are merely incomplete, not yet bridged over by a calcareous front, or are fully formed and covered only by a membranous frontal wall is not certain. One zoid on a single cyclostome-supporting branch appears to suggest the latter alternative. The ovicell surface is depressed and faintly, closely tuberculate (pl. 7,E) like the rest of the zooecial frontal. Its side walls are faintly raised and shaped like parentheses. The cavity of the ovicell measures 0.187 to 0.216 mm. (average 0.200 mm.) in length and 0.209 to 0.245 mm. (average 0.225 mm.) in width.

Avicularia: The avicularia (pl. 7,C,H) are small and vicarious and resemble in some respects those of *Melicerita latilaminata* (pls.

10,D; 11,D). It is a bit difficult to decide just where to take the length and width measurements of *Cellariaeforma parvimuralis* avicularia because of the difference in orientation of the lengthwise direction of the mandible and of the outer avicularial surface. In other words, the longitudinal axis of the mandible does not coincide with the longitudinal axis of the rest of the avicularium (pl. 7,H). Where it is uncertain as to which is the length and which is the width, these terms will not be used; instead, the more suitable terms "longer diameter" and "shorter diameter" will be used. Measurements for the whole visible avicularium were obtained from only three specimens: longer diameter from 0.230 mm. to 0.288 mm. (average 0.259 mm.); shorter diameter from 0.216 to 0.259 mm. (average 0.230 mm.). The outer avicularial opesia or opening measures 0.072 to 0.094 mm. (average 0.079 mm.) in length and 0.158 to 0.187 mm. (average 0.178 mm.) in width. The proximal median notch of the inside avicularian opening measures 0.029 to 0.043 mm. (average 0.034 mm.) in length and 0.043 mm. in width. The shape of the avicularia is a bit hard to determine because of so little material but those few examined seemed pentagonal and wedged between four zoids. The outer avicularian opening is spindle shaped but deeper within it is a proximal ledge which has a sizable notch in it (pl. 7,C). Mandibles were not observed. The avicularian openings are oriented diagonally with respect to the longitudinal axis of the zooecia.

Radicles: These may arise singly from the zooecial front but some zoids have as many as two or three coming through the cryptocyst and growing proximally (pl. 7,F). They are chitinous, sturdy, yet of small diameter, from 0.050 to 0.079 mm. (average 0.059 mm.).

Types: Holotype, USNM 11217; paratypes, USNM 11218.

Ecology: Only seven small fragments of this species were collected from Antarctic Station No. 104. Some of the colonies were invaded by large dark *Folliculina*-like protozoans whose shells protruded from the bryozoan's zooecial orifices. Another growth proved to be a cyclostomatous bryozoan.

Genus *Mawsonia* Livingstone, 1928

Diagnosis: Colony consists of a cylindrical sprig which may branch dichotomously. Internodes fused. Zooecia arranged in series around the longitudinal axis of the sprig. Zooecial walls flare outward noticeably around the depressed cryptocyst, framing it like a picture. Orifice longer than wide, a truncate oval, its distal end steeply arched, its proximal end flattened and provided with two conspicuous condyles at or near the corners. Avicularia generally large, vicarious, with a more or less sharply pointed long beak and mandible.

GENOTYPE: *Mawsonia membranacea* (Thornely, 1924). Type by original designation by Livingstone.

Mawsonia extensalata, new species

PLATES 8,D–F; 9,A–E

DIAGNOSIS: Colony cylindrical, branching dichotomously. Zooecia arranged in transverse series of 11 to 13 (or possibly more) around the longitudinal axis of the branch with great preciseness so that every other row is in alignment. Cryptocyst closely tubercled and projected outward into two huge wings, one on each side of the depressed orifice. These outward projecting wings give the species its name. Orifice longer than wide, curved distally, sides nearly parallel, proximal border very slightly concave. Two very prominent conical proximal condyles borne on a ledge growing from the inner side of the lower lip. Operculum, shaped like the orifice, possesses an inner chitinous flange especially prolonged at the two sides. Ovicells endotoichal, helmet shaped. Avicularia vicarious, as large as autozooecia, and with the pointed beak distally directed. Mandible large, subtriangular, keeled, falciform, and with a median peg projecting from its proximal border.

COLONY: The colony is sturdy and calcareous, branching dichotomously. The cylindrical branches are about 24 mm. long and from 1.792 to 2.106 mm. (average 2.001 mm.) in diameter. No visible joints occur at the branching but two of the short terminal branches show a slight constriction at the joint. An occasional inconspicuous transverse line, reminiscent of the constrictions found in the genus *Cellarinella* but not so wide, so constricted, or so pronounced, occurs along the branches of this species. Although there are variations and masking factors, areolation was more or less hexagonal. The zooecia are regularly arranged in transverse rows of 11 to 13 around the longitudinal axis of the branch (pl. 8,D). These figures, 11 to 13, are from counts made at the ends of two branches. Mathematical calculations show 14 to 15 zoids to be possible in a transverse series elsewhere along the stalk. The successive transverse rows are placed with such preciseness that the zooecia of every other row (i. e. first and third rows, second and fourth rows, etc.) are in perfect linear alignment with each other, giving the branch the appearance of a very fine file to the unaided eye. The roughness of the surface is due to the huge extended cryptocyst wings which project in pairs from the zooecia (pl. 8,D,E).

ZOOECIA: Zooecia are hexagonal in most cases although some are almost square. They are from 0.504 to 0.749 mm. (average 0.652 mm.) long, and from 0.346 to 0.562 mm. (average 0.505 mm.) wide.

The mural rims (external wall boundaries) of young zooecia (pl. 9,B). are thin and salient but become depressed in older ones as calcification becomes heavier. As calcification progresses, raised cryptocyst ridges which form a horseshoe-shaped arch (pl. 9,B) above and around the orifice change to two winglike projections or alae, one on each side of the orifice, like the blinders on a harness (pl. 8,E). They jut out so prominently that they are the most conspicuous characters of the colony, being recognizable even to the unaided eye. Their height is from 0.158 to 0.230 mm. (average 0.199 mm.), their thickness at the tip is from 0.043 to 0.058 mm. (average 0.053 mm.) and their length is from 0.259 to 0.331 mm. (average 0.305 mm.). Their edges are beaded. They are transversely striated, almost fluted at the edge. The parallel striations are due to the alignment of small tubercles into close rows along these alae (pl. 8,E). Parenthesis-like chitinous lines were not seen about the orifice. The rest of the frontal is depressed but closely tuberculate. The mural rim in older zooecia is depressed. The cryptocyst slopes up from it a bit and then slopes gently down to the depressed central region in which is located the orifice. The orifice is a slight distance from the distal mural arch or cornice and occupies a considerable amount of the frontal area (pl. 9,B). The orifice length is about one-third to two-fifths that of the visible zooecial length.

Zooecial orifice. The orifice is longer than wide, curved distally, the lateral sides about parallel, the proximal edge slightly concave. Deep within it and arising from a calcareous ledge that originates inside the proximal orifice border are two prominent conical condyles (pl. 9,B). These fit into oval depressions of the operculum (pl. 9,D,E). The operculum is from 0.216 to 0.259 mm. (average 0.238 mm.) long and from 0.130 to 0.173 mm. (average 0.156 mm.) wide. The chitinous operculum completely fits the orifice. Its inner border has a partial flange extending into a heavier flange for muscle attachment at the two nearly parallel sides (pl. 9,E). At the two proximal corners are the oval transparent areas or depressions for the condyles. The heavy chitinous flange thins out at the distal and proximal borders of the operculum.

Ovicells: The ovicell is salient, endotoichal, shallow, tipped back a bit, shaped externally like an acorn cup or Viking helmet and covered with small, closely set tubercles (pl. 8,E). It nestles partly between and beneath the side walls of the neighboring zoids in such a way that the cryptocyst ridges, or alae, of the neighboring zoids form a pair of wings on the ovicell. The opening into the ovicell is broadly ellipsoidal and some distance above the orifice of the zooecium. The ovicell length is difficult to estimate because of the overgrowth of neighboring zooecia but it seems to be from 0.216 to 0.331 mm.

(average 0.288 mm.) while the width is from 0.173 to 0.288 mm. (average 0.222 mm.).

Avicularia: The avicularia (pl. 8,D–F) are vicarious, replacing an autozoid in the regular transverse series. Their length is 0.619 to 1.101 mm. (average 0.796 mm.) and their width is 0.331 to 0.432 mm. (average 0.400 mm.). They are a bit longer and narrower than the autozoids, are diamond shaped, and have the beak directed distally. The beak part occupies a considerable section of the avicularian area and projects frontally. The rim of the proximal part of the avicularium is raised and beaded, enclosing a flat, notched shelf into which fits a chitinous peg from the mandible. The mandible (pl. 9,A,C) is subtriangular in full face but the apex curves like a sickle along the grooved beak. The proximal mandibular border is a bit wavy and from it projects a chitinous peg. Along the midline is a chitin-reinforced keel which terminates at one end in the sickled tip and at the other end divides into two chitinous sclerites which diverge toward the two basal corners. The length of the mandible is from 0.518 to 0.691 mm. (average 0.606 mm.); the width is from 0.274 to 0.346 mm. (average 0.307 mm.).

Types: Holotype, USNM 11220; paratypes, USNM 11221.

Distribution: This species was collected at Antarctic Stations 45 and 190. The specimen from Station 190 is a single, handsome, dichotomously branching sprig, while Station 45 yielded only two small fragments. Specimens were covered with fine algal debris.

Mawsonia membranacea (Thornely)

Plates 9,F–M; 10,A

Cellaria membranacea Thornely, 1924, p. 9, fig. 2.
Mawsonia membranacea Livingstone, 1928, p. 39.

Diagnosis: Colony club shaped. Zooecia arranged around the stalk in irregular series of 10 or 11 in the present collection specimens. Zooecial orifice as in genus. Salient cryptocyst ridges and chitinous parenthesis lines present. Their end points do not meet at bottom. Avicularia vicarious, as large as the autozoids. Mandible large, keeled, falciform, triangular in face view, well reinforced with chitin, and provided with a proximal median process. The mandibular keel curved at the tip of the beak. Ovicells endotoichal, according to Livingstone (1928, p. 39).

Colony: This species is represented by a single, 9-mm.-long, ivory colored, club-shaped fragment in the present collection. Its proximal part is a mass of thin transparent chitinous rootlets. Areolation of the colony is of the hexagonal type described by Hastings (1946, p. 235).

Zooecia: Zooecia are heavily calcified, especially around the edge or mural rim. Some are pentagonal, others hexagonal, and are arranged horizontally about the stem in a series of 10 or 11 zoids (pl. 9,M). In younger or less heavily calcified zooecia the mural rim is gently raised (pl. 9,H) but in most zooecia the calcification process is so advanced that the zooecial boundaries are depressed grooves (pls. 9,G,M; 10,A) and the frontal surfaces are slanted downward toward the mural rim. Zooecial length varies from 0.584 to 0.869 mm. (average 0.692 mm.) and width from 0.490 to 0.585 mm. (average 0.542 mm.). Raised cryptocyst ridges, somewhat beaded in spots, are present in some very old zoids (pls. 9,G; 10,A). Also, delicate, gently curved parentheses lines are present near each side of the aperture (pl. 9,G). They are thin yellow lines which do not meet at the top or bottom. In some zooecia and avicularia the cryptocyst may be faintly tuberculate.

Orifice: The zooecial orifice is a longer-than-wide truncate oval with two strong teeth placed at or near its two proximal corners (pl. 10,A). It is placed in a slightly depressed frontal area some distance away from the distal edge of the zooecium. The condyles or teeth articulate with the oval transparent areas on the operculum (pl. 9,G).

Operculum: The operculum has the shape of the orifice (pl. 9,G). Its length varies from 0.202 to 0.230 mm. (average 0.215 mm.) and its width from 0.130 to 0.158 mm. (average 0.149 mm.). The curved rim is chitin-reinforced. The proximal boundary is hard to distinguish. A sclerite extends from the outer border of each of the two oval transparent articular areas into which the orifice teeth fit.

Ovicells: No ovicells were seen in the sample. Livingstone (1928, p. 39) stated that they were endotoichal.

Avicularia: The avicularia are vicarious, replacing a zooecium in the horizontal series (pl. 9,M). Their shape varies from a diamond to an elongated pentagon (pl. 9,J–L), and their size is comparable to that of the zooecia. Avicularian length ranges from 0.664 to 0.837 mm. (average 0.774 mm.) and width from 0.316 to 0.411 mm. (average 0.363 mm.). The tip of the acutely triangular pointed beak is raised frontally (pl. 9,K,M). The opesia has a median proximal sinus bordered on each side by a ledge (pl. 9,J,K) with which the mandible articulates.

Mandible: The falciform mandible is sharply pointed, triangular in outline, with the distal tip curved inward (pl. 9,F,I,J). A pronounced keel and other chitinous reinforcements near the base, as well as the median peg which fits into the opesial notch, are characteristic of the mandible. The mandible is large, measuring from 0.403 to 0.461 mm. (average 0.437 mm.) in length and from 0.187 to 0.246 mm. (average 0.208 mm.) in width.

Radicles: The rootlets (pl. 9,M) are very thin-walled, tubular, and usually of small diameter except for one which is unusually wide. The diameters of these extremes, based on five readings, range from 0.072 to 0.547 mm. (average 0.202 mm.). The radicles grow proximally, forming a tangled bundle below.

Distribution: Thornely (1924, p. 9) described this species from Commonwealth Bay, Station 11, 351 fathoms. The U. S. Navy specimens came from Antarctic Station 44.

Genus *Melicerita* Milne-Edwards, 1836

Diagnosis: Colony erect, usually compressed or flattened, bilaminate, although in one species it may appear somewhat clavate and slightly pinched in or nodulated here and there. Zooecia hexagonal and arranged in transverse rows. Zooecial orifice crescent shaped, wider than long and provided with two teeth or condyles, one near each proximal corner. In some species of this genus there may be two more teeth, these latter placed on the distal wall of the orifice, making a total of four. Avicularia are vicarious and good sized but with comparatively small mandibles. Mandible arc shaped, very short and much broader than long.

The type species, as given by both Brown (1952) and Lagaaij (1952) is *Melicerita charlesworthii* Milne-Edwards, 1836.

Melicerita latilaminata, new species

Plates 10,B–J; 11,A–F

Diagnosis: Colony erect, calcareous, flattened, bilaminate, and dichotomously branched. Fronds broad. Cryptocyst beaded, translucent to opaque, depressed centrally. Modified parentheses lines and cryptocyst ridges present. Thin, slightly salient mural rim. Zooecial orifice broad, but short, and somewhat crescent shaped, with two prominent blunt condyles, one near each proximal corner. Orifice some distance away from the distal cornice. Ovicells endotoichal, inconspicuous, placed distally to the orifice. Their pore is small and crescent shaped. Avicularia large, but smaller than zooecia. Mandible a short wide arc, with a small median proximal tab which fits into a small, similarly shaped notch in the avicularium. Radicles spring from the front of some zooecia. Areolation hexagonal. The species is named for its broad flat fronds.

Colony: About 17 small fragments of this species are in the collection, none of them very large and none a complete colony. The largest fragment measures 17 mm. in length, and the widest region of any fragment measures 9 mm. The "colonies" are nonencrusting. They begin as a slender erect stalk from which radicles sprout down-

ward to attach to the substratum or other objects. The stalks quickly widen into a very flat, bilaminate blade which is broad but thin (pl. 10,B,C). Zooecia open out on the two faces of the frond. The number of zooecia in a horizontal row on one face varies from 3 to 18 (pl. 10,D,J). One of the fragments is dichotomously branched but no joints or nodes were seen in it (pl. 10,B). Areolation is hexagonal (pl. 10,D,J).

Zooecia: The visible frontal surface of the zooecia is hexagonal and quite angular, measuring from 0.518 to 0.677 mm. (average 0.579 mm.) in length and from 0.310 to 0.432 mm. (average 0.372 mm.) in width. However, there is more to a zooecium than this hexagonal front. A considerable stretch of the proximal part of each zooecium is hidden between the two zooecia directly below it (pls. 10,F; 11,B). Therefore, the total length of a zooecium (including both the visible and the hidden parts) ranges from 0.878 to 1.210 mm. (average 1.056 mm.). This hidden proximal part is long and narrower than the visible frontal hexagon. The body cavity is long, narrow, and somewhat spoon shaped in front view (pl. 10,F).

The proximal-distal walls between successive zooecia are porous (pls. 10,E; 11,C). One pore plate has 18 small pores, others have less.

The cryptocyst varies from translucent to nearly opaque, is calcareous, covered with small, rather closely spaced tubercles (pl. 11,D), and is gently convex, depressed centrally about the zooecial orifice. The orifice rim is slightly salient. The mural rims also are thin, narrow, well defined salient lines. Two distinct parenthesis-shaped chitinous lines about the orifice curve slightly outward and in reverse as they approach the center of the cryptocyst front (pl. 10,F). Cryptocyst ridges, also parentheses shaped but on a larger scale, are rather inconspicuous (pl. 11,D).

Zooecial orifice: The zooecial orifice is some distance away from the distal cornice of the frontal wall, in a depressed region of the cryptocyst, and is somewhat crescent shaped but with the ends gently curved instead of sharply pointed (pl. 10,F, and or in pl. 11,D). It is about three times wider than its central line length and about twice as wide as its all-inclusive, boxed-in length. Its dimensions are: over-all length from 0.094 to 0.130 mm. (average 0.107 mm.); length in midcentral line from 0.058 to 0.072 mm. (average 0.066 mm.), and width from 0.158 to 0.230 mm. (average 0.196 mm.). Its smooth rim is salient. The lower lip is curved slightly outward like the lip of a pitcher. Two proximal condyles are inside the orifice. No distal teeth were seen.

The operculum is the same shape as the orifice, which it fits snugly. It is a translucent yellow, with a pebbled surface (pl. 10,G). One of the marginal zooecia (along the edge of the blade) has an unusually

large orifice and operculum. The measurements of this very large specimen are: over-all boxed-in operculum length 0.115 mm., width 0.317 mm.

Ovicells. These occur between the zooecial orifice and the distal cornice of the frontal wall. Their shapes vary from oval to subtriangular, with frontal wall not much elevated above the level of the orifice and not higher than the mural rim. Dimensions: length from 0.115 to 0.158 mm. (average 0.135 mm.); width from 0.166 to 0.230 mm.(average 0.194 mm.). The thin-walled, distally placed ooeciopore is small and crescent shaped, measuring 0.022 to 0.043 mm. (average 0.035 mm.) in length and from 0.086 to 0.101 mm. (average 0.095 mm.) in width. Its lower lip is beaded but its upper lip is not (pl. 10,F).

Avicularium: The avicularia are vicarious and not numerous. Although good sized, they are not as large as the zooecia (pl. 11,D). They measure from 0.346 to 0.490 mm. (average 0.423 mm.) in length and from 0.245 to 0.403 mm. (average 0.292 mm.) in width. The size of the opesia into which the mandible fits is 0.086 to 0.101 mm. (average 0.097 mm.) long and from 0.144 to 0.187 mm. (average 0.167 mm.) wide. The chitinous mandible is wider than long, distally curved in a broad shallow arc and provided with a straight proximal border from which a small median tab projects into the corresponding notch in the opesia (pls. 10,H; 11,E,F). The mandibular rim is chitin-reinforced and a thinner circular area is present in the mid-region of the mandible.

Radicles: The rootlets are yellow to amber colored and translucent; slender, cylindrical to gnarled, and rigid-walled. They sprout from the frontal surface of the zoids and make their way toward the base of the colony (pl. 10,B,J). Their diameter is fairly uniform throughout, ranging from 0.058 to 0.076 mm. (average 0.072 mm.).

Types: Holotype, USNM 11223; paratypes, USNM 11224.

Distribution: This species occurred at Antarctic Station 104. No other species were growing over the colony fragments.

Melicerita obliqua (Thornely)

Plate 11,G–I

Aspidostoma obliquum Thornely, 1924, pp. 16–17, fig. 4.
Pseudocellaria obliqua Livingstone, 1928, p. 42.

Diagnosis: Colony flattened, nodulated, somewhat club shaped. Zooecia arranged in rows about it. Areolation and zooecia hexagonal. Crescentic orifice often placed obliquely, frontal depressed just beneath the lower lip. Operculum yellow and of same shape as the orifice. Cryptocyst and orifice rim granulated or beaded. Avicularia not observed. Ovicells large, imbedded between the two distal zooecia.

Ovicell opening narrow, arched and placed just above the margin of its zooecium.

Colony: Only two fragments, one 8 mm. and the other 10 mm. long, were found in the U. S. Navy collection. Their breadth varies from 1.079 to 1.479 mm. (average 1.299 mm.). Neither is branched. The two stalks are faintly nodulated. The nodulation consists of a mere pinching in or creasing of the proximal part of the zoids (pl. 11,G). The two fragments are too small to give a true picture of the frequency pattern of nodulation. In some areas, every other transverse series of zooecia is creased, then follow three to five transverse series with no nodulation. There is no difference in color of the "nodes" and "internodes."

Zooecia: Thornely did not mention the number of zooecia in each transverse series or on each face, and no measurements were given for the species. In the U. S. Navy specimens there are six zooecia in each transverse row, three opening out on one face, three on the other. The zooecia are calcareous, translucent, rather thin-walled and of a pale yellowish color. They are hexagonal, with distinctly angular corners and straight sides. Dimensions: length from 0.749 to 0.950 mm. (average 0.857 mm.); width from 0.446 to 0.619 mm. (average 0.533 mm.). Their frontal surface is slightly concave or depressed but especially so just beneath the lower lip (pl. 11,H). Also, the frontal surface and the orifice rim are beaded or covered with fine low tubercles placed close together. A thin, salient line outlines the zooecia. Radicles sprout from the front of some zooecia (pl. 11,G,I).

Zooecial orifice: The zooecial orifice is located some distance below the uppermost peak of the hexagon, the distance in some cases being almost twice the total length of the orifice. Many of the orifices obliquely placed, some tipped to the right, some to the left, and a few not oblique at all but set symmetrically (pl. 11,G,H). They are crescent shaped, slightly salient, and with beaded rim. The lower lip is thrust upward and forward as if in a pout (pl. 11,I). Immediately beneath it is a depressed area. Because the orifices are closely covered by a bright yellow, translucent to opaque operculum, the interior of the orifices is not clearly visible. In some zoids however, there appears to be a proximal calcareous ledge bearing two condyles. Operculum dimensions: length from 0.101 to 0.122 mm. (average 0.114 mm.); width from 0.187 to 0.216 mm. (average 0.202 mm.). The length was measured from the level of the two corners to the highest point in the midline.

Ovicells: No ovicells were seen in the U. S. Navy specimens. However, Thornely (1924, p. 16) gave an adequate picture and description of them. She described them as large, embedded between

and under the two next distal zooecia, and opening to the outside by an arched ooecial pore just above the margin of the zooecium. Measurements were not given.

Avicularia: Avicularia were not found either by Thornely or by the present writer, although it may be that had material been more plentiful avicularia might have been found. Brown (1952, pp. 165–166) discussed and illustrated a species, *Melicerita angustiloba* Tenison-Woods, which very closely resembles *M. obliqua* except that the former is a much smaller species and has a different type of ooeciopore.

Radicles: Chitinous tubules, cylindrical, thin-walled, transversely striated, arise from some of the zooecia (pl. 11,G,I). They emerge through the frontal below the orifice, enlarging in diameter a short distance out from the zoid. Measurements had to be made on flattened tubes at their thickest points. This diameter varies from 0.446 to 0.590 mm. (average 0.504 mm.).

Distribution: The U. S. Navy specimens were collected at Antarctic Station 44 from a depth of 100 fathoms. Thornely's specimens came from Commonwealth Bay, Station 12, at 110 fathoms.

III. FAMILY SCLERODOMIDAE

PLATES 12–18

The six species discussed in this study belong to the family Sclerodomidae Levinsen, 1909, genus *Cellarinella*. The genus has been reported by only four authors to date and all specimens have been from Antarctic collections. This article adds six new Antarctic species. The four previously known species did not occur in the collection of the U. S. Navy's 1947–48 expedition.

TAXONOMY AND MORPHOLOGY: Vigneaux (1949, pp. 17, 23) has introduced a much-needed reclassification of families and genera which would require critical study of a number of related species that time does not permit at present. He erected a new family, Lepraliellidae, to accommodate *Cellarinella*. However, Levinsen's classification, although not perfect yet, is based on very scholarly and thorough morphological studies and it is followed for the present.

Characteristics of the family are discussed in detail by Levinsen in his monograph (1909, pp. 301–304). He stated (p. 301): "The very small distal wall is provided with a number of small uniporous rosette plates and the lateral walls with a varying number of rosette plates with few (two or three) pores. There is a membranous or weakly chitinized operculum and a more or less well developed peristome . . . "

On the basis of the material examined in the 1947–48 collection the following amendments or modifications of his family diagnosis can be made. First, his "distal wall" is the end wall which separates one zooecium from the next one in the same linear series. It could be called the proximal wall or the distal wall, depending upon one's point of view or if describing the walls of a single zooecium. At any rate, this distal-proximal wall may consist of a sieve plate, i. e., a plate or wall containing a number of small pores (pls. 12,I,J; 13,C; 14,K; 15,F,G; 16,F; 17,F). Second, the rosette plates or pore plates of the lateral walls may sometimes contain more than two or three pores (pls. 12,I; 15,G,H; 17,C). Third, an operculum could not be found in any of the material.

Genus *Cellarinella* Waters, 1904

Zoarium calcareous, "nodulated," ranging from spindly or slender sprigs to heavy, flattened, fan-shaped bilaminate slabs. Branching sparse and dichotomous. Stalks elliptical to flattened strips in cross section, with zooecia opening on all faces. Ovicells hyperstomial.

Operculum lacking. Zooecial boundaries externally undistinguishable and unmarked. Frontal wall thick, heavily calcified and channeled. Lateral and back walls thin. End wall a porous plate with two calcareous processes leaning over the plate. Primary orifice wider than long, its proximal border modified or interrupted by an oral ledge. Avicularia of two kinds, one external, the other internal; both near the orifice, either below or to one side.

The four previously known species of this genus, all from the Antarctic, are *Cellarinella dubia* Waters 1904, *C. foveolata* Waters 1904, *C. nodulata* Waters 1904, and *C. watersi* Calvet 1909. Since its original description by Waters in 1904, the genus *Cellarinella* has been reported only in the papers of Calvet (1909), Thornely (1924), and Livingstone (1928) until the present record.

Levinsen's genus *Sclerodomus* (1909) has some of the same characteristics as *Cellarinella*, such as internal avicularium, externally undefinable zooecial boundaries, a channeled, heavily calcified frontal wall, and porous end wall. Because the 1947–48 collection yielded some intermediate forms it was thought best to retain Waters' names for *Cellarinella* and *Systenopora* as well as Levinsen's *Sclerodomus* but to modify or restrict one of them slightly. During the study of the six species of the 1947–48 collection the problem arose whether a new genus was needed to accommodate those species whose colonies formed heavy, bilaminate, fan-shaped yet dichotomously branched slabs (*C. njegovanae*, *C. roydsi*, and *C. watersi*). *C. nutti* is intermediate between the heavy slablike species and the spindly or tapelike species (*C. dubia*, *C. foveolata*, *C. laytoni*, *C. margueritae*, *C. nodulata*, and *C. rossi*). However, there were too few fully grown or complete colonies in some of the species to show the amount of possible variation in colony form to warrant erecting a new genus on growth form alone.

The genus appears to be very homogenous. Differences between species are rather slight insofar as individual zoids are concerned but are sometimes considerable when the zoarial growth habit and general colony appearance are considered. Their zoids show close relationship in that all have internal avicularia, external avicularia, frontal oral ledge, sieve plate end wall with two calcareous processes over it, a few rosette plates and numerous single pores definitely placed linearly in the lateral walls, a thick porous channeled frontal wall, and no visible external zooecial boundaries.

The orientation of the avicularia, both internal and external, and of the frontal oral ledge were found to be important in distinguishing one species from another. Previous authors have overlooked these characters or else have paid them scant attention; consequently, previously described species need be reexamined for these characters.

In the succeeding discussion of species the maximum-minimum-average measurements for particular parts or structures are based on 10 readings unless otherwise specified.

Cellarinella margueritae, new species

PLATE 12

DIAGNOSIS: Zoaria narrow, flattened, ribbonlike bilaminate strips, with some zoids opening out along the edges also. Two mucros, one in front of each proximal corner of the orifice. External avicularium along median side of one of the mucros, arranged at an approximate right angle to the longitudinal axis of the zoid. Internal avicularium slants obliquely distally. External avicularial mandible wider than long. Mandibles of both triangular and with a hooked tip. Orifice hemispherical distally, only slightly curved upward proximally because of the inner frontal oral ledge.

C. margueritae is so named because it was collected at Marguerite Bay, Antarctica. It differs from *C. nodulata*, depicted in Waters' monograph (1904, pl. 8, fig. 6a), in the number and position of mucros and the location of the external avicularium. In *C. nodulata* the mucro is central or median in location and the avicularium is decidedly lateral in position, at the very corner of the orifice, and directed obliquely upward and outward. In *C. margueritae* the mucros are two in number and lateral in position. The external avicularium extends from the midline outward, transversely.

ZOARIUM: 16 ivory-colored, calcareous, hard fragments of this species were found. The longest is 47 mm. Width is up to 4 mm. in some. Thickness of blade is about 2 mm. Judging from the presence or absence of the thin parchmentlike membranous covering over the colony some of the colonies were living, some dead, at the time of collection. The zoarium consists of a bilaminate, nodulated, flattened, narrow blade roughly resembling a tapeworm (pl. 12,A). Branching is sparse and dichotomous. Nodes and internodes differ in external appearance only in that the nodes are a bit more pinched-in and lack orifices, thus looking less pitted than the internodes. The nodes are not jointed or flexible but are of the same calcareous construction as the internodes. The internodes are from 4 to 8 mm. long. There are from 3 to 11 vertical rows of zoids in an internode. The number of zoids in a horizontal row across one face of an internode ranges from 5 to 10. The slightly prickly feel of the colony surface is due to the projecting mucros, usually two per zoid.

ZOOECIA: The only external indication of a zooecium is the orifice with its neighboring structures, the two mucros and the external avicularium. All other parts of the zooecium and its neighbors are

covered by a thick, channeled, heavily calcified frontal wall that hides all zooecial boundaries. The thickness of this wall is 0.230–0.504 mm. (average 0.334 mm.). The pores seen on the internal surface of the colony frontal (pl. 12, H) do not correspond in position to the pores seen on the external surface (pl. 12,B). The closely spaced frontal pores (pl. 12,B) are the external terminals of the channels (pl. 12,J). The internal pores (pl. 12,H) are the internal terminals of some of the channels. The channels diminish or deviate in their course (pl. 12,J) so that a good part of the internal frontal wall is imperforate.

Because external boundaries of zooecia are lacking, external measurements are somewhat approximate; nevertheless, measurements of zooecial length were made from orifice to orifice in a vertical series. By this method zooecial length was 1.37–2.02 mm. (average 1.65 mm.). These compare closely with the fewer measurements made on the internal surface of zooecia. Zooecial width (distance between the lateral walls) based on internal measurements was 0.302–0.389 mm. (average 0.363 mm.). Zooecial thickness (distance from the back wall to the external frontal surface) was 0.677–1.094 mm. (average 0.857 mm.). The side and back walls of zooecia are very thin, ranging from 0.007 to 0.022 mm. (average 0.014 mm.). The back walls are long, narrow, and nearly rectangular. The side walls are wider (pl. 12,I,J) and provided with bordering rows of single pores (pl. 12,H) and a few more medianly placed multiporous rosette plates (PP of pl. 12,I). The end wall is of variable thickness. Its edges are thicker than the multiporous central part (pl. 12,I,J and SP of pl. 12,J). Two irregular, heavily calcified processes (pl. 12,I and pl. 12,K) slant a bit over this proximal wall sieve plate. Their function is not known but it is possible that they serve for muscle attachment.

AVICULARIA: The internal avicularium is well hidden. It is not visible from the outside because of its low oblique position inside the zoid (pl. 12,D,H,I). It is placed below the side and corner of the orifice. Its pointed, curved beak points obliquely upward away from the frontal (pl. 12,E). It is on the side diagonally opposite the external avicularium. For example, if the internal avicularium is on the left side of the midline the external avicularium would be on the right, and vice versa (pl. 12,D). This condition and arrangement is found also in *C. roydsi*. Dimensions of the internal avicularia of *C. margueritae*: total length 0.187–0.230 mm. (average 0.204 mm.); total width 0.101–0.158 mm. (average 0.127 mm.); beak length 0.115–0.144 mm. (average 0.138 mm.); mandible length 0.108–0.130 mm. (average 0.117 mm.); mandible width 0.094–0.115 mm. (average 0.103 mm.). The total length and width and beak dimensions are based on only seven readings each, the mandible length on five and its

width on three readings. The internal avicularial mandible is of similar shape and appearance as mandibles of external avicularia (pl. 12,F).

The external avicularium is placed transversely beneath the orifice and to one side of the midline with the hemispherical (back) area in or touching the midline (pl. 12,C,D,G). A mucro tips its beak forward (pl. 12,D). Another mucro grows at its base, on the opposite side of the midline (pl. 12,B,D). The avicularial beak makes an approximate 110° angle with the semicircular area back of the mandible (pl. 12,G). External avicularium measurements: total length 0.216–0.288 mm. (average 0.264 mm.); total width 0.158–0.187 mm. (average 0.174 mm.); beak length 0.130–0.187 mm. (average 0.160 mm.); mandible length 0.101–0.122 mm. (average 0.133 mm.); mandible width 0.115–0.144 mm. (average 0.133 mm.).

All zoids had external avicularia.

Frontal oral ledge: A gently curved ledge (pl. 12,C–E, and fl of pl. 12,I) shields the internal avicularium from the outside. It is placed diagonally at a slight angle to the frontal surface (pl. 12,C, and fl of pl. 12,D). The angle is much smaller in this species than in *C. roydsi*. Compare the orifices and oral ledges of plate 12,B, with plate 17,A, and plate 12,C with plate 17,E.

Orifice: The shape of the zooecial orifice varies according to the degree of frontal wall calcification and development of frontal oral ledge and mucros. In the primary orifice the distal border is deeply curved but less than semicircular. The proximal border is faintly arched (pl. 12,C), but soon becomes obscured by the growth of the frontal oral ledge, the two umbos or mucros, and the external avicularium. The primary aperture is a bit smaller than the secondary aperture and both are wider than long. Primary orifice length is 0.173–0.230 mm. (average 0.192 mm.) and width is 0.245–0.302 mm. (average 0.269 mm.). Secondary orifice length is 0.202–0.266 mm. (average 0.236 mm.), its width 0.259–0.389 mm. (average 0.320 mm.).

Ovicells: Ovicells were not distinguishable externally. From the internal aspect they are globular and hyperstomial.

Types: Holotype, USNM 11227; paratypes, USNM 11228.

Ecology: The species was collected by the 1947–48 expedition at Station 234 in the Marguerite Bay area, Antarctica. Growing on living colonies of *C. margueritae* were bits of sponge, a calcareous worm tube, and some cyclostomatous bryozoans.

Cellarinella rossi, new species

Plate 13

Diagnosis: Zoarium narrow, flattened, ribbonlike, bilaminate, with some zoids opening along the edges also. Two mucros present, the naked one being considerably closer to one corner of the orifice than

the avicularium-bearing mucro which points away from the other orifice corner. The suboral external avicularium is placed on the median to oral side of this farthest mucro, so points at an angle of approximately 30° downward and outward away from the orifice. The inner avicularium is placed more or less transversely at the inner side-front of the zoid, so it cannot be seen from the outside. External avicularial mandible about as long as wide. Proximal border of primary orifice divided and considerably distorted by a vertical, diagonally directed frontal oral ledge. The most distinctive feature is the presence of an extensive projecting peristomial cap. The secondary orifice is sometimes very asymmetrical.

The species is named *C. rossi* because it was collected near Ross Island, Antarctica.

Zoarium: Only five sprigs, the longest of which is 28 mm. long, are in the collection. The colony varies in color from a light dull tan to ivory. The sprigs are narrow, tapelike, bilaminate, and one shows the beginning of another branch. The colony surface is slightly roughened, like a file, by the mucros. Orifices make tiny pits, just visible to the naked eye. Colony width varies from 2 to 4 mm. and its thickness is about 1 mm. at the tip of the sprig. The longest sprig has about six nodes. The nodes (pl. 13,A) are not flexible but are similar to those of the preceding species. The number of linear rows of zooecia in an internode (area between nodes) ranges from 3 to 11, while the number of rows of zooecia across one face of the colony, from edge to edge of an internode, varies from 6 to 13.

Zooecia: Zooecial boundaries are externally unmarked. Approximate zooecial length, externally, from one orifice to the next was 1.08–2.160 mm. (average 1.606 mm.). Internally the zooecia are shaped like inverted flasks (pl. 13,C). The channeled frontal wall is 0.202–0.374 mm. (average 0.274 mm.) thick at the upper center of the zooecium. The deviating and variable channels terminate in external frontal pores (pl. 13,B,D,H–J) of 0.022–0.122 mm. diameter at one end and some of them in internal frontal and lateral pores at the other end (pl. 13,C). Lateral and back walls are very thin, 0.014–0.022 mm. Lateral walls have a few large rosette plates near the mid-region and numerous single pores along the edge bordering the frontal wall. The back walls are flat, the lateral walls curve a bit, and the frontal inner wall curves considerably. Zooecial dimensions, as measured from the inner surface: width, from side wall to side wall, 0.187–0.389 mm. (average 0.299 mm.); thickness, from back wall to outside of front wall, 0.518–0.720 mm. (average 0.619 mm). The two calcareous processes over the end wall appear to be thinner than those of the preceding species (see pls. 12,I,K; 13,C).

Two colonies obviously collected in a living state were covered with a thin, light tan, parchment membrane. The frontal pores and channels were plugged with a brown substance. The membrane was stretched tightly over the colony in dried specimens. It apparently wears off or disintegrates from dead colonies.

Avicularia: Internal avicularia, though present, cannot be seen from any position on the outside because they are placed below and laterally to the rim of the orifice and because their beak is turned more laterally than obliquely, so the wall must be broken away to see them. The internal avicularium is a pointed oval with a triangular mandible that has a hooked tip. It has a hooked beak like the external avicularium although plate 13,E does not show it developed yet. The mandible closely resembles those of the external avicularium (pl. 13,F,G). Dimensions of one internal avicularium: total length 0.158 mm.; total width 0.101 mm.; beak length 0.101 mm.

The external avicularia are sharply pointed ovals cradled between two mucros below and to one side of the orifice (pl. 13,D,I–K). The two mucros vary in size; sometimes one, sometimes the other, is larger. One mucro is nearer the orifice corner than the other. The back area of the external avicularium rests against its base. The other mucro pushes the avicularial beak forward and tends to surround the avicularium, building up its walls (pl. 13,J,K). The external avicularium is always below and to one side of the orifice. Its beak usually points at about a 30° angle away from the lower edge of the orifice (pl. 13,K). External avicularium dimensions: total length 0.202–0.346 mm. (average 0.291 mm., based on 20 readings); total width 0.130–0.288 mm. (average 0.206 mm., from 20 readings); beak length 0.122–0.245 mm. (average 0.187 mm.); mandible length 0.108–0.144 mm. (average 0.123 mm.); mandible width 0.094–0.144 mm. (average 0.126 mm.). An old worn sample from which plate 12,K was drawn has some rather large external avicularia and also some smaller ones as in plate 13,D. An occasional avicularium points not downward but as in plate 13,J.

Frontal oral ledge: The oral ledge extends diagonally across the proximal border of the orifice at a greater angle with respect to the plane of the orifice and the internal avicularium (pl. 13,E,K) than in any of the other five new species.

Orifice: The most conspicuous feature of this species is the projecting visorlike peristome which shades the orifice (pl. 13,H–J). It may be worn down or broken off in some specimens, as happens also to the mucros. The peristome protects the three sides of the orifice. No zoids were found in which the peristome completely encircled the orifice. Waters (1904, p. 57) mentioned a "raised cap over the distal end" of the oral aperture of *Cellarinella foveolata* and also pictured it

(pl. 5, fig. 2a). However, *C. rossi* and *C. foveolata* differ in type of suboral avicularia and in mandibular shape, and the mucros seem to be absent from *C. foveolata*, at least they are not mentioned or figured by Waters.

The distal border of the primary orifice and the peristome arch in a neat semicircle. The proximal border of the orifice is distorted by the vertical-diagonal oral ledge (pl. 13,E,K) which interrupts it and helps to form a channeled groove that leads down from the orifice corner toward the nearest mucro (pl. 13,I). When the colony is old and the mucros, oral ledge, and oral channel well developed, the orifice looks very asymmetrical because one corner of it is pulled downward out of shape by the channel (pl. 13,B,I).

Dimensions of primary orifice: length 0.166–0.230 mm. (average 0.202 mm.); width 0.216–0.288 mm. (average 0.229 mm.).

Ovicells: Ovicells are present on some zooecia (pl. 13,H), absent on others (pl. 13,I). They are globose, covered over by the secondary calcified frontal layer and so are not easily distinguished from the surrounding zooecial fronts. Although pores may be present around and over much of the ovicell they do not perforate the ovicell frontal wall. Sometimes the pores outlining or over the ovicell may be larger than surrounding ones but that is not constant. Measurements of five ovicells: length about 0.259–0.331 mm. (average 0.288 mm.); width about 0.288–0.432 mm. (average 0.360 mm.).

Types: Holotype, USNM 11229; paratypes, USNM 11230.

Ecology: This species was collected at Antarctic Stations 44 and 104, off Cape Royds, Ross Island. No other species grew on the "living" colonies but dead colonies had some encrusting cheilostome and cyclostome Bryozoa. Some of the external avicularial mandibles were clamped tightly shut over long, fine, delicate rods which were either of sponge or alcyonaria.

Cellarinella nutti, new species

Plate 14

Diagnosis: Zoarium nodulated, bilaminate, flattened; seemingly transitional between the tapelike and slab species. Branching dichotomous. Internal avicularium transversely placed across the inner frontal wall at the level of the orifice so that its side wall shows readily from the outside. External avicularium, when present, points obliquely down and forward. Frontal oral ledge tangentially placed at side-back of the internal avicularium, high enough to show from the front. "Naked" back mucro near midline and nearest the orifice; forward, aviculariate mucro farther away from the midline and from orifice.

The species is named in honor of Comdr. David C. Nutt, who collected the Bryozoa of the expedition.

Zoarium: This species is represented by five calcareous, ivory-colored colony fragments; the three largest range from 20 to 24 mm. in length (pl. 14,A). The two smallest scraps are apparently basal, very much worn down and therefore of questionable identity. No measurements or drawings were made from these two fragments. None of the fragments is a complete, fully grown colony. The shape of the most perfect and symmetrical fragment (pl. 14,A) is somewhat flabellate or slablike. The other two sizable fragments are broken-off pieces neither basal nor terminal but cut at the branching zone, irregular and rather tapelike. Nodes occur about 3 to 6 mm. apart. They are neither flexible nor real joints, simply slightly depressed bands from which orifices are absent (pl. 14,A,B). There are 4 to 8 linear rows along an internode (between nodes) and 8 to 17 rows across one face of an internode (from side to side). Although the colony is bilaminate and most of the zooecia open out on the two flat faces, a few zoids open out on the thin edge also (pl. 14,G). Colony surface is pitted (pl. 14,B). The large holes are the orifices, the small ones are channeled frontal pores. The frontal pores are 0.014–0.058 mm. (average 0.040 mm.) across.

Zooecia: Zooecia are long and narrow. Length, based on external measurements, 1.08–2.059 mm. (average 1.670 mm.); width 0.238–0.360 mm. (average 0.285 mm.).

The zooecial surface is sometimes slightly ridged, especially about the orifice (pl. 14,E,H) and near the mucros (pl. 14,C). The side and back walls of the zooecia are thin. The front wall is channeled and 0.202–0.403 mm. (average 0.249 mm.) thick. The lateral walls have the customary appearance of other species in this genus, namely, a few large multiporous rosette plates along their midregion and one or two rows of small single pores along their frontal borders (pl. 15,H).

Avicularia: The internal avicularium cannot be recognized as such until the zooecium is tipped forward in order to look down into the orifice. The internal avicularium is placed transversely across the inner lower border of the orifice so that part of its side wall shows from the outside (pl. 14,E,F,H,K). It is sometimes slanted a bit to the left, sometimes to the right, so that in front view it is not horizontal. Its beak is slightly hooked. Measurements of the internal avicularium: total length 0.202–0.216 mm. (average 0.209 mm.); total width 0.086–0.144 mm. (average 0.109 mm.); beak length 0.130–0.158 mm. (average 0.143 mm.).

The external avicularium is directed obliquely downward at a considerable angle away from the orifice proximal border. It is near the midline (pl. 14,F–H,K), cradled between two mucros. The posterior

mucro is nearest the orifice and nearest the midline but still diagonally across from the anterior mucro. The posterior mucro is a bit to one side of the back area of the external avicularium (pl. 14,C,K). The anterior mucro, near the avicularial beak, is deflected away from the midline. In heavily calcified or old specimens the external avicularium may be deeply sunken and the mucros worn down or obliterated (pl. 14,D). In the few fragments of this species, external avicularia usually were present on the lower two or three rows of an internode and generally absent from the upper rows of an internode. Whether this is typical for the species or peculiar to the few fragments on hand is not certain at present. However, this condition does not seem to exist in the other five species. If an external avicularium is absent its anterior mucro is also absent, leaving only the mucro nearest the orifice. Dimensions of external avicularia: total length 0.144–0.187 mm. (average 0.169 mm.); total width 0.115–0.130 mm. (average 0.122 mm.); beak length 0.101–0.173 mm. (average 0.140 mm.); back area length 0.050–0.072 mm. (average 0.058 mm.).

Frontal oral ledge: At one side of the internal avicularial back area is a frontal ledge (fl of pl. 14,K) that shows from the front or outside as a partition across the base of the orifice (pl. 14,C,H,K). In plate 14,E,F it is small and poorly developed. *Cellarinella nutti* is intermediate between the two extremes, *C. rossi* and *C. njegovanae*, in the angle that the oral ledge makes with the plane of the frontal surface.

Orifice: The primary orifice is greater than a semicircle. Its lower border is interrupted by the internal avicularium and the oral ledge. It is 0.173–0.216 mm. (average 0.193 mm.) long and 0.230–0.259 mm. (average 0.246 mm.) wide. The secondary orifice is somewhat more orbicular (pl. 14,B) unless it begins to encompass some of the external avicularial zone (pl. 14,D). If nearly orbicular, and without the external avicularium beneath, it measures 0.216–0.288 mm. (average 0.233 mm.) long and 0.216–0.259 mm. (average 0.228 mm.) wide. If it grows down to enclose part of the external avicularium, as in plate 14,D, it measures 0.288–0.374 mm. (average 0.343 mm.) long and 0.216–0.288 mm. (average 0.238 mm.) wide.

Ovicell: Not observed.

Types: Holotype, USNM 11231; paratypes, USNM 11232.

Ecology: This species was collected at Antarctic Stations 44, 104, and 234. No other species were growing on the colonies.

Cellarinella njegovanae, new species

Plates 15; 16,A–I

Diagnosis: Zoarium bilaminate, nodulated, slablike and flattened. Branching dichotomous. Internal avicularium obliquely placed below

the corner of the orifice so as not to show from the outside. Two external avicularia, each set obliquely below the lower corner of the orifice, with beaks pointing diagonally upward and outward. Mucros absent. Primary orifice crescentic. Secondary orifice varies in shape from an inverted triangle to a more transverse slit, depending upon degree of overgrowth. Oral ledge, gently arched, forms the proximal border of the primary orifice and is nearly parallel with the frontal plane.

The species is named in honor of the writer's mother, whose maiden name was Njegovan.

Zoarium: The amount of material collected was four fair-sized pieces and some smaller fragments. Figures A and B of plate 15 represent the larger pieces. One was 33 mm. long. The zoarium is ivory-colored, heavily calcified, with chitinous rootlets sprouting from some of the basal zoids. An internode may have 2 to 18 rows of zoids along its length and 12 to 25 rows of zoids across its width, on one face. These counts were made on the broader blades and not on the narrow base. The colony surface is punctured by numerous channeled pores (pls. 15,C,D,H; 16,I). The zooecial orifices are visible to the naked eye.

Zooecia: Externally, zooecial boundaries are not distinct (pls. 15,C; 16,A); but internally and in cross section they are (pls. 15,D,H; 16,H). Approximate zooecial length, by external measurement from one orifice to the next orifice in line, 1.075–1.523 mm. (average 1.315 mm.), comparing favorably with that of a single zoid measured from the inside, 1.368 mm. Zooecial width, from inside measurements, 0.360–0.605 mm. (average 0.431 mm.).

Frontal walls are very thick, lateral and back walls are thin. As seen from the inner surface zooecia are shaped like inverted flasks. Their bulging upperpart is devoid of pores except at the sides; the narrow proximal part has a number of pores (pls. 15,D,E; 16,I). These pores open into some of the frontal channels. The back wall of the zooecium is flat (pls. 15,H; 16,H). The side wall has a few elliptical rosette plates near its midline (pl. 15,G,H). These may have up to 14 pores. Pore chamber length is 0.137–0.202 mm. (average 0.164 mm.) long and 0.086–0.137 mm. (average 0.111 mm.) wide (only four readings). In addition to these pore chambers, or rosette plates, the side wall also has a number of single pores, arranged roughly in two or three rows along the edge nearest the frontal wall (pl. 15,G,H). The end wall has the usual sieve plate and two calcareous processes, the latter a bit more elaborate than in the other species (pls. 15,G; 16,H).

In the node region the zooecial cavities are very greatly reduced by the encroachment of the walls (pl. 16H,).

Avicularia: An internal avicularium is present but does not show from the outside because it is placed low and obliquely, a bit to the side, as in plate 15,D. It has a hooked beak and triangular mandible, which also is hooked at the tip. The internal avicularium is 0.238 mm. long and 0.144 mm. wide, based on one reading. Its beak is about 0.17 mm. long.

External avicularia occur in pairs generally. However, an occasional zoid is found which has a single external avicularium at the usual location. Mucros are absent. An external avicularium leans against each lower corner just below the primary orifice. The avicularium is bent so that the beak and the back area are in different planes. This is most accurately shown in only one drawing (pl. 16,A, lower row of zoids, second avicularium from the left), although it is the common condition. The external avicularium normally points obliquely upward and outward. Its beak and mandible are hooked and triangular (pl. 16,A,B). External avicularium measurements: total length 0.158–0.202 mm. (average 0.171 mm.); total width 0.115–0.137 mm. (average 0.121 mm.); mandible length 0.072–0.101 mm. (average 0.088 mm), width 0.101–0.122 mm. (average 0.109 mm.).

Frontal oral ledge. The frontal oral ledge is parallel to the plane of the orifice (pls. 15,D,E,G; 16,C,I). Plate 16,D shows a young orifice that has not yet developed the ledge.

Orifice: The young, just-forming primary orifice is nearly hemispherical (pl. 16,D). A fully formed primary orifice, complete with oral ledge as its proximal boundary, is crescentic (pls. 15,D; 16,C). As calcification of the frontal wall proceeds, the primary orifice is deeply buried and can no longer be fully studied from the front (pls. 15,G; 16,A). There is a gradual overgrowth that eventually results in a secondary orifice whose distal wall is either straight or arched gently forward and whose sides lead down to the external avicularia, thus enclosing an area shaped like an inverted triangle (pl. 16,A). The upper surface of the overhanging upper edge may be tubercled. Dimensions of the orifices: primary orifice length 0.130–0.187 mm. (average 0.156 mm.), width 0.245–0.317 mm. (average 0.284 mm.); secondary orifice length 0.144–0.245 mm. (average 0.190 mm.), width, 0.202–0.360 mm. (average 0.301 mm.).

Ovicells: Present on some zooecia, not on others. It is difficult to tell externally in heavily calcified pieces whether an ovicell is present, but it is easy enough in very young zoids. Where the frontal wall has not become too thick the ovicell outlines are barely visible (pl. 15,E). In older zoids the frontal over the ovicells becomes thick (pl. 15,G) and they are harder to recognize. They are covered by a secondary porous or channeled layer but their own inner wall is not

porous. A prominent ledge (BL of pl. 15,G) juts out from the back wall where the ovicell joins its zooecium. This back ledge arises from the end wall region of the zoid behind the ovicell (pl. 15,G). This condition obtains for other species of this genus also (pls. 12,D; 14,K; 17,C,F). The ovicells are globular. Their dimensions, from broken colony fragments and based on three readings only: length 0.346–0.360 mm. (average 0.350 mm.); width 0.331 mm.

TYPES: Holotype, USNM 11235; paratypes, USNM 11236.

ECOLOGY: This species was collected at Antarctic Stations 44, 45, and 104. Also growing on the colonies were a worm tube and a cyclostomatous bryozoan.

Cellarinella roydsi, new species

PLATES 16,J,K; 17,A–I

DIAGNOSIS: Zoarium a heavily calcified, nodulated, flattened, bilaminate slab. Shape flabellate. Branching dichotomous. Two mucros below the orifice cradle an external avicularium which is transversely placed across the front of the zooecium from the midline outward. Mucros in front of and below the orifice, lateral, not median, to it. Internal avicularium obliquely oriented and placed high enough so its strongly curved beak shows in the orifice, from the outside. The diagonally directed frontal oral ledge also shows from the outside.

The species is named after its collection site, Cape Royds, Ross Island.

ZOARIUM: Eight good-sized chunks (as in pl. 16,J,K,) ranging from 29 to 54 mm. in height, from 5 to 37 mm. in width, and from 1½ to about 2¼ mm. in thickness, were in the collection. There were also a few smaller fragments.

The colony is ivory-colored, nodulated. Nodes are approximately one-half to 1 mm. long, internodes 2 to 10 mm. long. The number of rows of zooecia across the face of an internode, from one side edge to the other, is about 20 to 88. The number of rows of zooecia along an internode (longitudinally), from one node to the next, is about 6 to 14.

Rootlets are present on some of the fragments. They sometimes branch.

The zoarium is bilaminate and flattened, with most of the zooecia opening out on the two faces and a few on the edges also.

ZOOECIA: Zooecial boundaries are not definable externally. External measurements, taken from orifice to orifice in the same linear series, gave approximate lengths of 1.008 to 1.944 mm. (average 1.513 mm.). Zooecial width, based on inside measurements, 0.302–0.576 mm. (average 0.383 mm.). Zooecial thickness (distance from

the back wall to the outside frontal surface), 0.763–1.109 mm. (average 0.933 mm.).

The zooecial walls are as in other species of the genus (pl. 17,C,F). The back wall has occasional small pores, very few in number. The side wall has rosette plates, and a couple of rows of single pores at its frontal border. Side wall 0.007–0.014 mm. (average 0.010 mm.) thick. Channeled frontal wall 0.144–0.446 mm. (average 0.301 mm.) thick; its frontal pores irregular and 0.029–0.079 mm. (average 0.055 mm.) in diameter.

Avicularia: An internal avicularium is obliquely placed to one side of the orifice high enough for the tip of its hooked beak to show a little from the outside (pl. 17, A–G). In fact, it is almost vertical in orientation. Dimensions: total length 0.187–0.288 mm. (average 0.247 mm.); total width 0.122–0.158 mm. (average 0.142 mm.); beak length 0.115–0.187 mm. (average 0.157 mm.); mandible length 0.115–0.144 mm. (average 0.126 mm.), width 0.108–0.130 mm. (average 0.107 mm.).

A sharply pointed external avicularium, transversely placed, is cradled between two mucros. Its back area is usually on or near the imaginary midline which passes through the orifice. Its bent and hooked beak rests against one of the mucros (pl. 17,A,E,H), which is farther away from the midline than the "naked" mucro, which is very near or in front of the corner of the orifice. An occasional zoid has two external avicularia (pl. 17,G) with a mucro between them. Likewise, a rare zoid may lack the external avicularium. Measurements for external avicularia: total length 0.187–0.259 mm. (average 0.233 mm.); total width 0.115–0.202 mm. (average 0.159 mm.); beak length 0.130–0.158 mm. (average 0.144 mm.); mandible length 0.101–0.130 mm. (average 0.114 mm.); mandible width 0.115–0.173 mm. (average 0.134 mm.).

Frontal oral ledge. The frontal oral ledge cuts diagonally outward across the floor of the primary orifice (pls. 17,A–C,E–G). Its plane is at a considerable angle to the plane of the internal avicularium. However, this angle is not as great as in *C. rossi* (see pl. 13,E,K) but is greater than in the other four species of the collection.

Orifice: The orifice is arched distally and a bit lopsided rather than a perfect semicircle. Also, to add to the distortion, the curved oral ledge gives the orifice a crescentic shape and makes it appear set somewhat obliquely into the frontal surface (pl. 17,A,B). A shallow groove appears between the internal avicularium (pl. 17,F) and the oral ledge, outward. The primary orifice is 0.202–0.288 mm. (average 0.243 mm.) long and 0.267–0.389 mm. (average 0.332 mm.) wide. The secondary orifice is a bit larger: length 0.245–0.317 mm. (average

0.287 mm.), width 0.288–0.389 mm. (average 0.341 mm.). The front of the ovicell encroaches on the peristomeal passageway, as shown in side view in plate 17,C and in front view in plate 17,B.

Ovicell: Ovicells are globular and not easily distinguished externally except for their frontal wall, which intrudes upon the orifice (pl. 17,B,C). Measurements for ovicell interiors: length 0.360–0.504 mm. (average 0.428 mm.), width 0.331–0.432 mm. (average 0.370 mm.).

Tentacle number: Some zoids were killed in an expanded condition. Their extended tentacles were dried on the colony surface, around the orifice. The tentacles numbered 20 on one zoid and approximately that, so far as could be determined, on a second.

Types: Holotype, USNM 11239; paratypes, USNM 11240.

Ecology: This species was collected at Antarctic Stations 104, 190, and 234. Some of the living fragments were encrusted with a sponge, some with other Bryozoa such as *Barentsia discreta*, *Phylactella lyrulata*, and *Smittina* sp.

Cellarinella laytoni, new species

Plate 18

Diagnosis: Zoarium somewhat cylindrical but with a definitely serrated appearance caused by the excessively large mucros. Occasionally nodulated. Branching sparse. Zooecia open on all sides of the stalk. Two unusually prominent mucros, one at each proximal corner of the orifice, form a projecting platform below and in front of the orifice. Frontal ridges converge toward the mucros. One mucro supports the external avicularium, on its median side. External avicularium beak points transversely outward or slightly distally (upward). Internal avicularium obliquely placed below one corner of the orifice within the zooecium, its curved beak just barely visible from the outside. Frontal oral ledge reduced, barely recognizable. Mandible of external avicularium longer than wide and not so strongly hooked at the tip as is the internal avicularial mandible.

The species is named in honor of Mr. Layton, who assisted Comdr. Nutt in the collection of some of the Bryozoa.

Zoarium: The collection yielded nine ivory-colored fragments, of which the longest is 27 mm. Some are about 2 mm. in diameter. The sprigs have a jagged or serrate outline because of the huge projecting mucros (pl. 18,A,B). Zooecia open on all sides (pl. 18,E). Nodes (pl. 18,F) are more frequent or recognizable in the younger than in the older fragments. The colony surface is pitted with channeled pores as in the preceding species. In some places, especially about the mucros, converging ridges groove the surface (pl. 18,A,C).

Zooecia: Approximate external zooecial length measurements, from orifice to succeeding orifice: 1.296–1.728 mm. (average 1.492 mm.). The zooecial front is somewhat bracket-shaped (pl. 18,A,B). Immediately below the orifice the two mucros jut out with their cradled external avicularium to form a broad, irregular shelf in front of and below the orifice (pl. 18,C–E). From there on downward (proximally) the zooecial frontal slopes gradually inward toward the orifice of the zooecium below (pl. 18,A). The front wall is much thicker than the side or back walls. The process of zooecial development and calcification can best be observed in the incomplete, forming zooecia at the tip of the colony (pl. 18,B). The thin, smooth, innermost calcareous layer forming the front of the zooecium is the olocyst. Over it, beginning around the areolar pores, spreads the channeled porous tremocyst whose thickness increases with age. The number of pores is considerably reduced over the ovicell. Thus, it is possible to recognize ovicelled zoids from sterile ones. A few zoids developed chitinous rootlets (pl. 18,F,G).

Avicularia: Each zoid has an internal and an external avicularium. Occasionally a zoid will show two instead of one external avicularium (pl. 18,G). The base or back area of the external avicularium is on or near the midline. The beak rests against the inner side of one of the mucros. This points it obliquely forward and somewhat distally. The placement of the external avicularium therefore ranges from transverse to a slight oblique distal inclination that sometimes amounts to a 30° or 40° angle. Measurements from the external avicularia: total length 0.144–0.230 mm. (average 0.189 mm.); total width 0.101–0.144 mm. (average 0.118 mm.); mandible length 0.101–0.130 mm. (average 0.112 mm.); mandible width 0.086–0.101 mm. (average 0.097 mm.); beak length 0.115–0.158 mm. (average 0.140 mm.).

The internal avicularium is placed obliquely below and to the side of a corner of the orifice (pl. 18,C–E). The tip of its strongly hooked beak is just barely visible from the outside and points upward and outward, somewhat. The internal avicularial mandible is triangular, strongly hooked, and chitinized (pl. 18,I). The external avicularial mandible is a bit more rounded at the tip and only slightly hooked (pl. 18,H). Measurements for internal avicularia: beak length 0.144 mm.; mandible length 0.086–0.130 mm. (average 0.115 mm.), width 0.072–0.122 mm. (average 0.103 mm.). Beak length and mandible width are from only three readings, mandible length from six.

Frontal oral ledge: A thin, long rim acts as the oral ledge in this species. It extends from the side of the inner avicularium to the opposite side of the orifice (see pl. 18,C–E). It is so thin and narrow that it could easily be overlooked.

Orifice: The primary orifice is gently arched distally. It is so deeply set back of the mucros that its proximal border is completely hidden from view. Nonovicelled zoids (lowest one in pl. 18,A) show pores along the peristomie; ovicelled zooecia generally show none or exceedingly few, but have the ovicell frontal projecting down into the peristomial canal a bit. Dimensions of the primary orifice: length 0.173–0.230 mm. (average 0.192 mm.), width 0.302–0.331 mm. (average 0.320 mm.).

Ovicells: An ovicell forms a low, scarcely recognizable mound above the orifice. When observed from the inside the ovicells are globular. Only two were measured: lengths 0.374 and 0.403 mm., widths 0.346 and 0.374 mm.

Types: Holotype, USNM 11243; paratypes, USNM 11244.

Ecology: This species was dredged at Antarctic Station 104. Only a few zoids of a cheilostome and a cyclostome (Bryozoa) and a calcareous worm tube grew on some colonies.

Discussion

The six species of the 1947–48 collection were extremely bothersome because of the great similarity between them. They have the following structures or characteristics in common:

Thick channeled porous frontal wall.
Thin back and side walls.
Side wall has a few longitudinal rows of single pores along its frontal border and several multiporous rosette plates further in.
Two types of avicularia, one inside the zooecial cavity near the orifice, the other outside, also near the orifice. They are similar in appearance but differ in location and orientation.
End wall with a sieve plate and two calcareous processes.
Ovicell hyperstomial and immersed, difficult to see from the outside.
Presence of a frontal oral ledge which modifies the proximal border of the arched primary orifice.
Colony with nodes and internodes.
Triangular mandible in avicularia.

The same six species of the 1947–48 collection differ on the following specific points:

Orientation of the internal avicularium.
Orientation of the external avicularium.
Number of external avicularia per zoid.
Presence or absence of peristomial cap or visor.
Orientation of the frontal oral ledge.
General appearance of the colony or the growth form that it assumes.
Number and location of the mucros.

The internal avicularium is horizontal in position in *C. nutti* and *C. rossi*. It is oblique in position in the other four new species.

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As for the orientation of the external avicularium, in *C. roydsi* it is horizontal or nearly so. In *C. laytoni* and *C. margueritae* it tends to point a bit more obliquely upward from horizontal. In *C. njegovanae* it is much more oblique, pointing upward at a considerable angle from horizontal. In *C. rossi* it points obliquely downward at a very slight angle from the horizontal. In *C. nutti* it points downward and forward at a very considerable angle from the horizontal.

The normal number of external avicularia per zoid is two in *C. njegovanae* and one in the other five new species, although occasional zooecia do break the rule.

A very prominent peristomial cap or visor occurs in *C. rossi*. It is absent in *C. laytoni*, *C. margueritae*, *C. nutti*, and *C. roydsi*. In *C. njegovanae* the secondary orifice is formed by an extraordinary downward growth of the frontal wall, reminding one of a face mask.

The orientation of the frontal oral ledge is another important species character. The oral ledge is parallel with the zooecial middle front in *C. njegovanae*. In *C. laytoni* it is parallel with only one-half the frontal and with one side, following the curve of the zooecial orifice. *In C. margueritae* and *C. nutti* the ledge cuts across or encroaches upon the proximal border of the primary orifice at a very slight angle. The ledge cuts diagonally across the proximal border of the primary orifice at a very considerable angle in *C. rossi* and *C. roydsi*.

In general zoarial characters, i. e., gross appearance of the colony, three distinct types are evident. One is the serrate cylinder or column, as represented by *C. laytoni*; a second is the narrow, flattened, tapelike colony as represented by *C. margueritae* and *C. rossi;* and a third type is the heavy, bilaminate, flattened, flabellate or fan-shaped slab as represented by *C. njegovanae*, *C. roydsi*, and *C. watersi*. *Cellarinella nutti* was intermediate between the slab and tape species.

IV. FAMILIES UMBONULIDAE AND SMITTINIDAE

PLATES 19–35

This fourth article on the Bryozoa collected by the U. S. Navy's 1947–48 Antarctic Expedition discusses 16 species and subspecies, one from the family Umbonulidae and 15 from the family Smittinidae. Of these, only 5 have been previously described, the remaining 11 are new. Other species which in the past have been included among the Smittinidae but which are now known to belong to other families have been left for later papers in this series.

In the case of new species, complete morphological data is given on any structure which could be of taxonomic importance; in the case of previously reported species, old descriptions have been augmented wherever possible by new, additional data. The family Smittinidae is one of especial difficulty because of the seemingly great variability of its species. Moreover, over the years, the emphasis has changed on what should be considered important or good diagnostic features, so that it is not uncommon to find an old species description, sometimes unaccompanied by a figure, which is so general that it will fit a large number of related species just as easily as it will fit its own.

The aims of this article are to present the range of variation of the species, to depict the diagnostic features to the fullest degree, to add ecological data, and, wherever possible, to compare the Antarctic Bryozoa with closely related Bryozoa from other localities because the Antarctic forms exhibit some unusual features that may be of evolutionary or taxonomic significance if found to apply to groups other than the Bryozoa.

All illustrations were drawn with the aid of a camera lucida unless otherwise stated in the captions. Measurements are based on 10 samples unless otherwise specified in the lists.

ABBREVIATIONS USED IN LISTS OF MEASUREMENTS

Z–L, zooecial length (from proximal to distal end).
Z–W, zooecial width (at widest point).
Z–H, zooecial height (from back wall to front wall).
Av–L, avicularia, total length (including both mandibular or beak and back areas).
Av–W, avicularia, width at widest point.
B–L, beak length. (Where an avicularial mandible is lacking it may still be desirable to measure the avicularial beak or space normally occupied by a mandible.)
Pr–Or–L, primary orifice length, inside measurement.
Pr–Or–W, primary orifice width, inside measurement.

Se–Or–L, secondary orifice length. (Usually this is an inside measurement, especially if the peristome is of any thickness, but if the peristome is exceedingly thin and elevated and invariable in thickness throughout the colony it might be an outside measurement from proximal to distal border.)

Se–Or–W, secondary orifice width.

Se–Or–Si–D, secondary orifice including sinus depth.

Se–Or–Si–W, secondary orifice including sinus, width at top.

Ly–L, lyrula length or height.

Ly-W, lyrula width.

Pe–D, depth of the peristomial cavity (distance between primary and secondary orifices).

Ov–L, ovicell length.

Ov–W, ovicell width.

ZC–H, zooecial cavity height (from back to frontal wall; in zooecia which have very thick walls, inside measurements).

ZC–W, zooecial cavity, width, inside measurements.

FW–T, frontal wall thickness.

LW–T, lateral wall thickness.

M–L, mandible length.

M–W, mandible width.

Op–L, operculum length or height.

Op–W, operculum width.

CS–L, compensation sac area length as marked on inner wall of the zooecial frontal.

CS–W, compensation sac area width as marked on inner frontal wall.

OS–L, oral spine length.

OS–T, oral spine thickness or diameter.

PN–L, peristomial notch or sinus, length or height.

PN–W, peristomial notch or sinus, width at widest part just short of the tip or end.

AP–D, areolar pore diameter at widest.

Family Umbonulidae

Family Umbonulidae was established for *Umbonula* species by Canu (1904, p. 18) without a formal description (Hastings 1949b, pp. 526–527). Since then its characteristics have been formally stated by Osburn (1952, p. 298) and Bassler (1953, p. G196). Hastings, in comparing the genera *Umbonula* and *Hippopleurifera*, suggests that the two are related closely enough to be put into the same family—Umbonulidae of Canu. At present these are the only two genera in the family.

Osburn sets down the family characters thus: Frontal "a pleurocyst, with strong costules and large pores; the aperture large, suborbicular or subquadrangular, without cardelles or very small ones . . . peristome low or wanting . . . ovicell large and hyperstomial or wanting." Bassler states them as follows: "Like Petraliidae but with prominent umbo on zooecial front below aperture and median avicularium; cardelles and lyrules absent." Under Petraliidae he gives the zooecial frontal as a tremocyst and for *Umbonula* as a pleurocyst.

The above family descriptions have to be modified somewhat because some of the *Hippopleurifera* and *Umbonula* species do not conform to the above-stated family characteristics—the former in its frontal and the latter in regard to avicularial position and presence of a simulating median denticle.

Hippopleurifera apparently may have either a pleurocyst or a tremocyst (Osburn, 1952, pl. 35, fig. 7; pl. 36, fig. 1; and Hastings, 1949, pl. 12). Two *Umbonula* species may have a median process which might pass for a lyrula. *Umbonula arctica* (Sars) 1850 has a median process of a size varying from a point (Osburn, 1952, pl. 36, fig. 6) to a sizable toothlike mucro (Robertson, 1908, pl. 23, fig. 78). *Umbonula dentata* (Waters) 1904 is midway between these two extremes, having a delicate, bifid, incurving denticle simulating a lyrula or mucro. In view of the above deviations it is believed the family should be characterized as follows.

Diagnosis: Frontal a tremocyst or pleurocyst. Pleurocyst sometimes forms areolae, costulae, and a prominent umbo. Umbo occasionally directed orally, like a median denticle. Orifice large, suborbicular to subquadrangular. Peristome poorly developed or absent. Avicularia either single, median and below, or lateral or about, with respect to the orifice. Ovicell hyperstomial and usually perforated.

Brown (1952, pp. 288–289) does not recognize the family Umbonulidae but includes *Umbonula* with *Escharoides* and *Exochella* in the family Exochellidae.

The taxonomic status of the Umbonulidae should be more carefully studied, particularly in its relationship to the Petraliidae, Exochellidae, and Smittinidae, because it is not yet clearly defined and because some of its species intergrade with the other families. Incidentally, for many years *Umbonula* has been classed with the Smittinidae.

Genus *Umbonula* Hincks, 1880

Umbonella Hincks, 1880, pp. 316–317, text.

Umbonula Hincks, 1880, atlas, pl. 39 (Hincks used the name *Umbonella* in the text, then discovered it was preoccupied and corrected it in the atlas).—Canu and Bassler, 1920, p. 494.—Hastings, 1944, pp. 273–284; 1949a, pp. 205–211.—Lagaaij, 1952, p. 90.—Brown, 1952, pp. 288–289, 304–308.—Bassler, 1953, p. G196.

The above synonymy refers to significant papers only.

Remarks: Hincks' original description of the genus is as follows: " . . . primary orifice suborbicular or subquadrangular, lower margin slightly curved inwards, peristome not elevated, no secondary orifice; a prominent umbo (? avicularian cell) immediately below the mouth, supporting an avicularium . . . encrusting."

To this Canu and Bassler formally add "frontal is a pleurocyst with costules surrounded by areolae . . . 20–30 tentacles . . . neither lyrula nor cardelles." To this Brown (p. 305) adds "ovicells with radiating pores or finely perforate." Lastly, Lagaaij adds "Avicularia paired, lateral to the orifice, or single, embedded in the distal slope of the umbo."

Umbonula patens (Smitt) pictured by Osburn (1952, pl. 36, fig. 3) has an imperforate ovicell but other *Umbonula* species seem to agree with Brown's characterization of the ovicell. No complete, undamaged ovicells were found on *U. dentata*, so that species still needs clarification on that point.

DIAGNOSIS: Zooecia encrusting. Frontal an areolate pleurocyst. Ovicell hyperstomial. Peristome poorly developed. Sometimes an aviculiferous suboral umbo, sometimes avicularia are paired and lateral. Lyrula absent or sometimes simulated by a median frontal process. Orifice large, subcircular to subquadrangular.

TYPE SPECIES: Hastings (1944), after a detailed study of the literature and a careful examination of old museum collections of *Umbonula verrucosa* (=*Cellepora verrucosa* Esper 1790), erected *Umbonula ovicellata* Hastings 1944 as the type species.

Umbonula dentata (Waters)

PLATE 19

Smittia dentata Waters, 1904, p. 71, pl. 4, fig. 8.—Brown, 1952, p. 307.

DIAGNOSIS: Zooecia encrusting, ovate to hexagonal. Frontal convex, areolated. Orifice large, depressed; with a median variable bidentate process. Two small oval avicularia, obliquely placed, one at each proximal corner of the orifice, have hemispherical mandible directed upward and outward. A third similar avicularium sometimes on proximal frontal, directed toward nearest orifice(?). Ovicell hyperstomial but no further data on it available at present.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.807–1.109 (0.929)	Ly–L, 0.022–0.058 (0.037)
Z–W, 0.576–0.634 (0.593)	Ly–W, 0.029–0.063 (0.046)
Av–L, 0.095–0.108 (0.102)	Ov–L, 0.288–0.346 (0.320, only four)
Av–W, 0.072–0.086 (0.081)	Ov–W, 0.360–0.432 (0.387, only four)
Pr–Or–L, 0.187–0.245 (0.216)	Op–L, 0.130–0.144 (only 2)
Pr–Or–W, 0.202–0.230 (0.219)	Op–W, 0.187–0.216 (only 2)
Se–Or–L, 0.216–0.230 (0.219)	M–L, 0.042–0.052 (0.046)
Se–Or–W, 0.194–0.245 (0.220)	M–W, 0.056–0.065 (0.058)

ZOARIUM: Zoarium white, encrusting, rather thin-walled. Waters described the species from only one piece, a fragment which lacked ovicells. The U. S. Navy collection material also consisted of one piece of about 20 fairly good zoids growing on another species and only a few broken or incomplete ovicells were present, although on none had the frontal wall become fully formed.

ZOOECIA: Zooecia ovate to hexagonal, their vertical walls somewhat curved rather than angular planes. Frontal wall strongly convex,

granular, with a row of large areolae separated from each other by short ridges at the periphery. Periphery depressed, with an occasional salient mural rim. Central area of front moundlike, better calcified and more elevated than the rest of the zooecium. Zooecial boundaries distinct.

Avicularia: Two small oval avicularia usually present and always in the same position, one at each proximal corner of the orifice. An occasional zooecium may lack one of these. The oral avicularia are obliquely mounted on a small mound with their beaks pointing upward and outward. A third avicularium is sometimes found on the frontal, at the proximal end of the zoid (pl. 19,C), similar in appearance to the oral ones and pointing toward the nearest orifice. Only two such avicularia are in the fragment, both incomplete. Waters' specimens apparently lacked them, since he does not mention them. Mandibles of both types are similar, hemispherical and reinforced with a chitinous rim.

Orifice: The large variable primary orifice is often more angular than rounded, appearing quadrangular to hexagonal in some zoids. Distally it is rounded. Proximally it is straighter and more contracted. A small thin bidentate process (?lyrula or umbo) slants inward from the center. Secondary orifice lepralioid. The three bordering zooecial frontal walls aid in the formation of the short distal and lateral peristome. The primary orifice is depressed below the level of the rest of the frontal wall. The operculum is chitin-rimmed around its upper hemispherical border but the boundaries of its thin lower border could not be determined readily on our specimens.

Ovicells: Waters' specimens lacked ovicells. The current specimens have young, salient, globose, hyperstomial ovicells whose frontal wall has not yet been put in. So, the ovicell frontal remains undescribed until more material is found.

Distribution and ecology: The present specimen grew on a heavy mushroom-shaped species collected from Marguerite Bay, Station 180, in an 85–105-fathom dredge haul. Waters' specimens were on a stone from a greater depth (500? meters) some distance south and west (lat. 70°00′ S., long. 80°48′ W.) of the U. S. Navy specimens.

Affinities: Waters felt that this species closely resembled *Mucronella bicuspis* Hincks 1883, now *Umbonula* (Brown, 1952, p. 305). Brown (p. 307) felt that Waters' *Smittia dentata* is not a *Smittina* but might possibly be an *Umbonula*.

A species very close to *U. dentata* but differing in the orientation of the two avicularia and in the width and stoutness of the "lyrula" is *U. arctica* (Sars) 1850, pictured by Osburn (1952, pl. 36, fig. 6) and Robertson (1908, pl. 23, fig. 78).

Family Smittinidae

Smittiidae Levinsen, 1902, p. 26.
Smittinidae Levinsen, 1909, pp. 335–336.—Canu and Bassler, 1920, pp. 453–455.—Vigneaux, 1949, pp. 91–92.—Brown, 1952, p. 311.—Osburn, 1952, p. 390.

The above synonymy refers to significant references only.

Remarks: Some of the species of this family have at one time or another occupied positions in various families including the Escharidae, Escharellidae, Exochellidae, Mucronellidae, etc. However, all the Antarctic species discussed below can be comfortably contained in the family Smittinidae.

Levinsen, in 1902, defined Smittiidae as possessing "Hyperstomial ooecia, generally with pores; both the distal wall and the lateral walls with a number (ca. 4–8) of single pored rosette plates." Later, in 1909, he extended the definition "The zooecia are seldom provided with 1–8 spines. A vestibular arch is wanting or weakly developed. The avicularia are rarely lateral and a median symmetrically or asymmetrically placed avicularium appears most frequently. The ooecia have as a rule a calcified, very rarely membranous ectooecium, which is usually provided with pores. Rosette plates with one or several pores, more lately pore chambers."

Canu and Bassler (1920, p. 453) add these features to the family diagnosis: " . . . ovicell . . . hyperstomial . . . opens into the peristomie. The peristome is produced and channeled in front. The operculum . . . lower edge is straight or slightly curved inward and hardly separated from the ectocyst." The frontal wall layers, particularly the pleurocyst, are mentioned by Canu, Bassler, Osburn, and others.

Brown (1952, p. 311) gives the most concise statement of family characteristics: "Ascophora possessing a median lyrula and lateral condyles in the primary orifice. Peristome often raised and channelled proximally to accommodate an oral avicularium which may, however, be frontal. Oral spines usually present. Ovicell with or without a porous ectooecium. Frontal wall evenly perforate or with marginal areolae."

Bassler (1953, p. G207) recently made a very important move to replace the family Smittinidae by family Mucronellidae Levinsen 1902 (p. 26), listing 23 genera (pp. G207–210) under it. Most of these genera can be conveniently divided into three major groups on the basis of their frontal wall: olocyst, pleurocyst or tremocyst. Those with an olocyst are listed as *Cysticella*, *Hemicyclopora*, and *Jaculina*, while those with a pleurocyst are *Mucronella*, *Palmicellaria*, *Parasmittina*, *Porella*, *Rhamphostomella*, *Rimulostoma*, *Smittoidea*, *Bryocryptella*, and *Marguetta*. Some *Rhamphostomella* are also listed by

Osburn and others as having only an olocyst. Many of the above (with pleurocyst) may have areolar pores, and some might even have occasional pores elsewhere over the front. Those genera with a tremocyst (frontal perforated more or less all over with pores, rather than only with areolae) are *Codonellina*, *Cyphonella*, *Plagiosmittia*, *Schizosmittina*, *Smittina*, and *Smittinella*.

Osburn (1952, p. 392) gave a key to nine smittinid genera which covers all but one (*Smittinella*) of the genera to be discussed in the present study.

Genus *Mucronella* Hincks, 1877

Mucronella Hincks, 1877, p. 526 (defines genus); 1879, p. 162; 1880, p. 360.—Levinsen, 1902, p. 26 (erects family); 1909, pp. 336, 343 (places part of Hincks, *Mucronella* under *Discopora*, family Smittinidae).—Canu and Bassler, 1920, pp. 474–475.—Brown, 1952, pp. 297, 337, 380.—Bassler, 1953, p. G207.

The above synonymy refers to significant references only.

Remarks: *Mucronella* at present is in a very controversial state because of the recent excellent publications by Bassler (1953), Brown (1952), and Lagaaij (1952). The controversy is over whether *Berenicea immersa* Fleming 1828 (unillustrated and most uncritically defined) is the same as *Lepralia peachii* Johnston (1847, pl. 55, figs. 5, 6), and whether genus *Escharella* Gray 1848, whose genotype is the questionable *B. immersa*, is a valid genus.

Bassler considers *Lepralia peachii* Johnston 1847 (now *Mucronella peachii*) the type species of the genus *Mucronella*. Brown detaches some of the *Mucronella* species (as has been the custom among various workers) to other genera: *Escharella*, *Escharoides*, *Exochella*, *Petraliella*, *Umbonula*, etc. Whether he still retains the original genus *Mucronella* is not clear. At any rate he consigns *Lepralia peachii* Johnston 1847 to *Berenicea immersa* Fleming 1828 as a synonym and uses *B. immersa* as the type species of the genus *Escharella* Gray 1848. But Bassler (1935, p. 105; 1953, p. G235) maintains that *Escharella* is an unrecognized and unnacceptable genus because its genotype, *B. immersa* Fleming 1828, is a doubtful species. Following is Fleming's original description of *B. immersa*, from page 533 of both his first (1828) and his second (1842) editions: "Cells forming an even, rough crust; the mouths declining, small, with a blunt tooth on the proximal margin. On shells and corallines from deep water. Crust rather thick, of a brownish colour; the divisions of the cells indistinct, the cells themselves being only a little elevated towards the aperture; the whole surface minutely granular." Johnston's account and illustrations of *L. peachii* are more precise. It would seem that Fleming's *B. immersa* might be considered a dubious name.

This genus is represented by one species in the present Antarctic collection.

DIAGNOSIS: Zoarium encrusting; frontal areolate; avicularia absent; primary orifice smittinoid, with lyrula; secondary orifice with peristome; umbo sometimes present; ovicell hyperstomial and imperforate.

GENOTYPE: *Lepralia peachii* Johnston, 1847 (p. 315).

Mucronella crozetensis (Waters)

PLATE 20

Mucronella ventricosa var. *multispinata* Busk, 1884, pp. 160–161, pl. 22, fig. 11.
Smittia crozetensis (new name) Waters, 1904, p. 64, pl. 8, fig. 15a,b.
Mucronella crozetensis, Canu and Bassler, 1920, p. 475.—Livingstone, 1928, p. 66.

DIAGNOSIS: Zoarium encrusting. Zooecia ovate or hexagonal, narrowing suddenly upward to the narrow elevated peristome. Stout pointed mucro in front of small lyrula. Lyrula bifid, trifid, or with more points projecting in various planes. No cardelles. Primary and secondary orifices otherwise nearly circular and small. Pleurocyst frontal with one or two rows of tiny slitlike peripheral pores. Base partly membranous, partly calcareous. Ovicell small, globose, nonporous, slanting back from peristome. Peristomial spines usually 6 to 8, the bases of some encroaching on the ovicell front.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.432–1.11 mm. (0.802)
Z–W, 0.346–0.740 mm. (0.579)
Pr–Or–L, 0.115–0.130 (0.117)
Pr–Or–W, 0.122–0.158 (0.139)
Se–Or–L, 0.202–0.252 (0.224, outside)
Se–Or–W, 0.209–0.259 (0.233, outside)
Se–Or–L, 0.101–0.130 (0.114, inside)
Se–Or–W, 0.115–0.144 (0.135, inside)
Ov–L, 0.230–0.274 (0.258)
Ov–W, 0.252–0.389 (0.318)
Ly–L, 0.022–0.043 (0.038)
Ly–W, 0.040–0.069 (0.047, at base)
Ly–W, 0.058–0.086 (0.069, at top)

ZOARIUM: Dull, white to ivory, encrusting, attached to a rocky substratum by calcareous zooecial rims and membranous bases.

ZOOECIA: Distinct, ovate to hexagonal, highly convex, mound-shaped, porcellanous. Mural rims depressed. Each zooecium arises from a base that is centrally membranous and peripherally calcareous (pl. 20, H). The membranous bases of neighboring zoids are connected by numerous, slender, yellow to brown canals (pl. 20, D,K). Waters did not report them for *M. crozetensis* but in *Lepralia frigida* did find only one tube to each neighboring zoid (1904, p. 47, pl. 8, fig. 9). *Mucronella crozetensis* has 5 to 10 tubules connecting with each neighboring zoid. In *Mucronella*, canals leaving the distal half of a zoid have constrictions within the confines of that zoid, but those leaving the proximal half of the same zoid do not have them (pl. 20,K). Several small fiber bundles (parietal muscles?) attach to the basal membrane at the more distal sides.

The zooecial frontal wall is an olocyst overlaid by a pleurocyst. The olocyst, seen in one zoid only (from "Rock 7") is a beautiful smooth glistening white, with tiny bordering pores. The pleurocyst is thick and patterned (pl. 20, A,G,H). It has one or two alternating rows of tiny slitlike peripheral pores which perforate the thick wall. The peristome, mucro, and ovicell are the most elevated parts of the frontal surface.

Avicularia: Absent.

Orifice: Both the primary and secondary orifices are very small, nearly circular, and well raised above the rest of the frontal surface. They are frontal in position, some distance from the distal end of the zooecium. The thick but short peristome supports a mucro that is a stout spike or flattened triangle (pl. 20,F,H). Delicate, hollow, hyaline spines, usually 6 to 8 in number, arise from the thickened basal supports (pl. 20,C,H). When an ovicell is present the peristome continues at least partly across the ovicell rim and carries with it these spine bases (pl. 20,E,G). A small lyrula, occasionally simple but usually with several peaks and points projecting in various planes, is in the primary orifice just back of the mucro (pl. 20,A,D,I,J). Figure B is the most typical one. The lyrula of one young zoid (from Station 44) was typically trifid when viewed from the front but when the same zoid was tipped forward the lyrula looked flat as in *Mucronella ventricosa.*

Ovicells: Nonporous, globose, comparatively small, thick-walled and pushed back from the peristome. Their surface is roughened. Peristomial spine bases may encroach upon their frontal rim.

Distribution and ecology: A rock from Station 184, bryozoan crusts of a reteporid and *Smittina abditavicularis* from Station 44, and a rock arbitrarily labeled No. 7 (station unknown) are substrates for *Mucronella crozetensis* of the U. S. Navy collection.

This species has been previously reported by Busk, Waters, and Livingstone. Its longitudinal range so far extends from 89°15′ W. (Waters) to 101°13′ E. (Station 44), and its latitudinal range is from 46°47′ S. (Busk) to 71°19′ S. (Waters). It has been collected at depths from 80 to 210 fathoms (Busk).

Its substrates, in addition to gravel and rocks, include other Bryozoa (reported by Rogick) and a valve of *Terebratula* (reported by Busk).

Affinities: This species is most closely related to if not an actual variety of *Mucronella ventricosa* (Hassall) as pictured by Hincks (1880, pl. 50, figs. 6–8) except for some differences in appearance and number of oral spines; size, number of rows, and position of frontal pores; and texture of pleurocyst and, especially, the lyrula. Osburn's (1933, pl. 15, fig. 7) *Mucronella ventricosa* has the same textured

pleurocyst as *M. crozetensis* but its orifice differs. Waters (1899, p. 9; 1904, p. 64) discusses the affinities and reason for the change of name from Busk's original identification to the present species name.

Genus *Parasmittina* Osburn, 1952

Parasmittina, Osburn, 1952, pp. 392, 411–412.—Bassler, 1953, p. G208.

Osburn erected this genus for those species of *Smittina* having an areolated pleurocyst; well developed lyrula, cardelles, and peristome; perforated ovicell; and avicularium variously placed but never median, suboral, or with central bilaterally symmetrical avicularial chamber. He designates the type species as *Lepralia jeffreysi* Norman 1876 (now *Parasmittina*).

Parasmittina hymanae, new species

PLATE 21

DIAGNOSIS: Zoarium encrusting. Zooecial boundaries distinct. Convex frontal an areolate beaded pleurocyst. Avicularium broadly oval or elliptical, always placed over a corner areolar pore. Some zoids without avicularia, others with one, two, or three. Mandibles thumb-nail shaped, with broadly chitinized border. Ovicells nonporous, globose, but bordered by areolar pores. Peristome incomplete distally in ovicelled zooecia but complete in nonovicelled zooecia. Peristome raised, with flat frontal mucro bordered by a sinus on each side. Primary orifice hemispherical, with a medium-sized lyrula and cardelles. Operculum approximately hemispherical, with reinforced sides and edge. Compensation sac occupies most of the frontal area.

Parasmittina hymanae is named in honor of the distinguished zoologist Dr. Libbie Hyman of the American Museum of Natural History.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.835–1.224 (0.983)
Z–W, 0.590–0.821 (0.716)
Av–L, 0.115–0.144 (0.123)
Av–W, 0.072–0.101 (0.084)
Pr–Or–L, 0.101–0.144 (0.119, four readings)
Pr–Or–W, 0.144–0.202 (0.180, four readings)
Se–Or–L, 0.130–0.173 (0.146)
Se–Or–W, 0.144–0.166 (0.154)
Ly–L, 0.014–0.029 (0.023)
Ly–W, 0.050–0.058 (0.056, at tip)
Ly–W, 0.050–0.072 (0.069, at base)
Ov–L, 0.302–0.360 (0.358)
Ov–W, 0.346–0.418 (0.403)
Op–L, 0.115–0.158 (0.138)
Op–W, 0.180–0.223 (0.206)
M–L, 0.058–0.072 (0.061)
M–W, 0.055–0.072 (0.063)
CS–L, 0.374–0.662 (0.497)
CS–W, 0.288–.0533 (0.388)
AP–D, 0.043–0.072 (0.059)

Zoarium: The ivory-colored zoarium forms a dense crust on rocks. The convexity of the individual zooecia gives it a bumpy appearance. The largest colony is 3 cm. in diameter.

Zooecia: The large, distinctly outlined hexagonal zooecia have a thick frontal that is a smooth areolate olocyst covered by a closely and beautifully beaded areolate pleurocyst. It is convex, sloping upward from all sides to the elevated peristome. A row of rounded, regularly spaced areolar pores is set close to the thin mural rim. The frontal between the pores is not noticeably ribbed. The rest of the frontal surface is not porous. The compensation sac area occupies about four-fifths of the inner zooecial frontal surface. On the under zooecial surface from three to five (usually four) large oval dietellae are present in the distal half of the zoids.

Avicularia: One to three broadly elliptical avicularia may occur on some zoids, or be entirely absent. They are always peripheral in location, developing on the corner areolar pores and not occurring elsewhere on the frontal (pl. 21,D,E). The avicularial chamber is small. The short, broad, thumb-nail shaped mandibles are reinforced by a wide chitinous border and always oriented outward, toward the zooecial periphery (p. 21,G). The beak is slightly longer than the more hemispherical back area (pl. 21,B,C).

Orifice: The frontally elevated orifice is a short distance from the zooecial distal border. A collarlike peristome hides much of the primary orifice, which is hemispherical, smittinoid, and provided with a low medium-wide lyrula and cardelles. The hemispherical operculum has lateral sclerites (pl. 21,H,I). There is no oral avicularium. The peristomial collar is broadly notched frontally in two places. Between these two gaps it rises into a lip or mucro (pl. 21,D). In nonovicelled zoids the collar is complete distally, but in ovicelled zooecia the ovicell interrupts it (pl. 21,D).

Ovicell: The salient, globose, nonporous ovicell has a beautifully beaded surface. It is outlined by a row of areolar pores which perforate the frontal of the surrounding zoid but not the ovicell itself. Neither the peristome nor the walls of the neighboring zoids encroach upon its surface.

Distribution and ecology: The holotype of this species (USNM 11296) is from Station 184 (Marguerite Bay); paratypes were found on Rocks 8, 18, 19 (stations unknown). Numerous Foraminifera are incorporated into the zooecial bases or overgrown by specimens from Rock 19. Some of the zooecia have several brown bodies inside.

Affinities: This is a handsome species, reminding one more of the genus *Mucronella* than of *Smittina* except for the presence of the avicularia.

Genus *Rhamphostomella* von Lorenz, 1886

Rhamphostomella von Lorenz, 1886, p. 11.—Hincks, 1889, pp. 424–426.—Canu and Bassler, 1920, pp. 476–477.—Lagaaij, 1952, p. 102.—Osburn, 1952, pp. 424–425.—Bassler, 1953, p. G208.

Remarks: Hincks quotes fully von Lorenz's original diagnosis of the genus and adds the following: "Zooecia oval, the walls thin, of delicate shining material, smooth (frequently traversed by radiating costae) entire (destitute of pores); orifice ample, arched above, lower margin straight or slightly curved, within it a median denticle, below it or upon it an aviculiferous rostrum. Ooecium semicircular or subcrescentic, perforated."

Canu and Bassler add that there is a lyrula and a pleurocyst and that the hyperstomial ovicell is closed by the operculum.

Lagaaij states that previous workers, as Waters, noted areolar pores which were not a feature of the original generic characterizations, thus necessitating a modification of Hincks' and Lorenz's diagnoses. Another necessary modification is that the ovicell sometimes is imperforate (as in the *R. ovata* (Smitt) of Osburn). *Rhamphostomella bassleri*, new species, has a single small frontal pit on the ovicell ectooecium, which in advanced calcification is calcified (i. e., the pit), and the ovicell is outlined by some areolar pores which do not penetrate the ovicell proper. *Rhamphostomella costata* von Lorenz 1886 is the genotype (Canu and Bassler, 1920, p. 477).

Rhamphostomella bassleri, new species

Plate 22

Diagnosis: Zoarium encrusting to foliaceous, unilaminate. Zooecia suddenly convex. Distal walls a modified inverted V. Mural rims thin, not salient. Frontal areolated. Areolae numerous, medium sized, close together and almost tubular on one side because frontal rises upward so fast. Interareolar costae short. Primary orifice smittinoid, with cardelles and a low broad lyrula. Operculum hemispherical. Secondary orifice lepralioid to faintly trifoliate, obscured by a large, cone-shaped aviculiferous mucro. Pointed avicularium on one side of the mucro. One or two other smaller mucronate avicularia often present in various positions on frontal. Mandible triangular, with hooked tip. Two frontal pores present below and to the back side of the oral avicularial chamber. Ovicells globose, nonporous, tipped forward partly over the orifice.

Rhamphostomella bassleri is named in honor of Dr. R. S. Bassler of the Smithsonian Institution, to whom bryozoologists owe an immense debt of gratitude.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see page 271).

Z–L 0.851–1.184 (1.019)
Z–W 0.481–0.888 (0.683)
Pr–Or–L 0.173–0.216 (0.189)
Pr–Or–W 0.209–0.230 (0.218)
Ly–L 0.014–0.029 (0.027)
Ly–W 0.086–0.115 (0.100)
Op–L 0.158–0.187 (0.173)
Op–W 0.228–0.266 (0.251)
Se–Or–L 0.158–0.230 (0.194)
Se–Or–W (anter) 0.180–0.238 (0.198)
Se–Or–W (poster) 0.230–0.302 (0.275)
Av–L 0.144–0.187 (0.160, oral avic.)
Av–W 0.086–0.101 (0.094, oral avic.)
M–L 0.094–0.173 (0.112, oral avic.)
M–W 0.065–0.094 (0.077, oral avic.)
Av–L 0.115–0.158 (0.139, frontal avic.)
Av–W 0.058–0.101 (0.078, frontal avic.)
M–L 0.058–0.066 (0.059, frontal avic.)
M–W 0.050–0.072 (0.063, frontal avic.)
Ov–L 0.296–0.407 (0.353)
Ov–W 0.370–0.481 (0.429)

ZOARIUM: Some zoarial fragments encrust other Bryozoa and rocks while other fragments (edges of colonies) form free, flat, thin, foliaceous, unilaminate chips. They are ivory-colored, often well calcified. Some contain polypides and ovicells with pale orange-colored embryos. Colonies in the collection are not complete; the biggest fragment, from Station 190, measures 18 mm. by 24 mm.

ZOOECIA: Zooecial shapes vary considerably. Zooecia are usually hexagonal, with the distal half of the zooecium generally broader and rounder than the proximal half, and with the distal walls curved from an arch to a modified inverted V (pl. 22,B,C,N). Sometimes even a gap occurs in the distal wall (pl. 22,N). The curved-to-angular lateral walls have five to seven pore plates. Zooecial frontal boundaries are distinct because of the single row of rounded, numerous, closely set areolar pores which are placed so close to the mural rim and because of the sudden convexity of the zooecia. The areolar pores are more or less tubular in appearance, the lateral wall of the tube short, the mesiad wall longer, because of the sudden rise of the frontal zooecial wall. The rest of the frontal is nonporous except for two, occasionally three, pores transversely or obliquely placed below and to one side of the oral mucro (pl. 22,A–C,O). These two pores are always present at the base of the oral avicularial chamber but not elsewhere and not in connection with the frontal avicularia.

The olocyst is thin, smooth, areolated. The pleurocyst, also areolated, is thicker, and granular to beaded. The ribs between the areolae are prominent but short, and not continuing up very far along the side of the zoid.

AVICULARIA: Two types of avicularia, the oral and the frontal, may occur. The oral is present on every completed zooecium (pl. 22,D, E). One or two frontals may occur on some zoids (pl. 22, A–C), or entirely absent on others (pl. 22,D,O). The oral avicularium varies from considerably larger down to frontal avicularium size. The avicularial chamber is large in the oral type (pl. 22,L) and small in the

frontal type (pl. 22,C). Otherwise, in avicularial shape and mandibular appearance the two types are quite similar or intergrade into each other. The oral avicularium is mounted on the side of the mucro, facing either to the left or to the right, with beak pointing outward (pl. 22,D,F). Sometimes the mucro and beak have a slightly curved tip. The mucro houses the avicularial chamber. The frontal avicularia also are mounted along the side of a smaller umbo. They generally face toward the middle of the zooecium (pl. 22,A) although some variations occur. They may be located anywhere on the frontal but usually are on the proximal half of the zoid, only rarely near the peristome.

The oral mandible is roughly triangular, gently curved, and has a hooked beak (pl. 22,G,I,J). Its outer border is more chitinized than the central area. The frontal avicularium mandible is similar in appearance.

Orifice: The orifice is nearly terminal. Its distal peristomial wall is formed in part by the next distal zooecium. The primary orifice is usually obscured or hidden by the peristome and aviculiferous mucro. It is a bit wider than long, smittinoid, with cardelles and a low broad lyrula (pl. 22,E,L). Its operculum is thin and lightly chitinized. The secondary orifice varies from lepralioid (pl. 22,B) to approximately trifoliate (pl. 22,O). Its anter is hemispherical, its poster is much wider and flatter. The oral avicularium-bearing mucro projects prominently in front of it. The peristome is highest at the sides of the orifice and low at the proximal corners. No spines were seen about the orifice.

Ovicellis: Salient, nonporous, globose, well calcified, tipped forward, partly overhanging the orifice. Some have a shallow oval or almond-shaped depression (pl. 22,A,O) near the border. Areolar pores of the next distal zoid sometimes outline the ovicell but do not perforate the ovicell wall. Ovicell surface is granular to beaded, occasionally a bit grooved. Embryos present in ovicells collected from Station 190.

Distribution and Ecology: The holotype of this species (USNM 11289) comes from Station 190; paratypes were taken at Station 44 and from Rocks 3 and 7 (locality unknown). Stations 44 (lat. 65° 25′ S., long. 101°13′ E.) and 190 (Marguerite Bay) are a considerable distance apart. No entire colonies are in the lot, only pieces, the biggest of which is 18 mm. by 24 mm. The piece from Station 44 grows on *Cellarinella rossi* (see p. 260). The three pieces from Station 190 are free, foliaceous chips, with polypides and embryos. On back of these colony pieces, but not on the face, grow a calcareous worm tube and various Bryozoa (*Ramphonotus inermis*, *Membraniporella* zoid, ancestrula, and an attachment rootlet) as well as sponge spicules. The specimens encrusting Rocks 3 and 7 were removed by calcining.

Affinities. Osburn (1952, p. 425) mentions two broad groups of *Rhamphostomella* species. One group has a strongly ribbed frontal wall, frontal avicularia, no cardelles, and a primary orifice which is strongly arcuate, sometimes having a lyrula. The second group has a plain, thinner frontal wall, without prominent costules, with frontal avicularia wanting, and primary orifice with distinct lyrula and cardelles. The Antarctic species *R. bassleri* is intermediate between the two groups. It favors the second group but has frontal avicularia and short costules.

Genus *Smittina* Norman, 1903

Smittia Hincks (preoccupied), 1879, p. 160; 1880, pp. 340–341.—Levinsen, 1902, p. 26.—Waters, 1904, p. 61.

Smittina Norman, 1903, p. 120.—Levinsen, 1909, p. 339.—Canu and Bassler, 1920, p. 457 (genotype as *Lepralia reticulata* MacGillivray, 1842 (cf. *Smittoidea*)).—Lagaaij, 1952, p. 94.—Brown, 1952, pp. 319–320 (sets genotype as *Lepralia landsborovii* Johnston 1847 and chooses neotype (cf. *Smittoidea*)).—Osburn, 1952, pp. 390–391 (splits genus into 3 genera, retaining *S. landsborovii* for *Smittina* proper).—Bassler, 1953, p. G209.

The above synonymy refers to significant papers only.

Remarks: Hincks (1880) stated: "The cardinal character of this genus is the elevated secondary orifice, produced and channeled in front. The dentate lower margin is common to it." This still holds. The genus, as newly restricted by Osburn, is characterized below.

Diagnosis: Frontal a tremocyst, hyperstomial ovicell with pores; lyrula, cardelles and peristome present; a symmetrically developed median suboral avicularium included either within the peristomial fold, spanning it, below it, or sometimes even fitting into a gap in the peristome.

The genotype is *Lepralia landsborovii* Johnston (1847, p. 310, pl. 54, fig. 9).

Smittina abditavicularis, new species

Plate 23

Porella malouinensis Livingstone, 1928, pl. 6, fig. 7; pl. 7, fig. 2; text fig. 15, pp. 66–68.

Diagnosis: Zoarium encrusting. Zooecia elongated, boxlike. Frontal a thick, nearly flat tremocyst. Secondary orifice clithridiate, primary orifice smittinoid, with small lyrula and sizable cardelles; a small oval oral avicularium obliquely placed inside between the two orifices. Ovicell unknown.

The species is named for its hidden avicularium, from the Latin "abditus" (hidden, secret, removed) and "avicula" (diminutive of bird).

350640—56——5

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 1.238–1.872 (1.594)
Z–W, 0.619–0.864 (0.729)
Z–H, 0.533–1.022 (0.749)
Av–L, 0.058–0.086 (0.073)
Av–W, 0.043–0.065 (0.055)
B–L, 0.036–0.050 (0.043)
Pr–Or–L, 0.158–0.187 (0.169)
Pr–Or–W, 0.230–0.259 (0.243)
Se–Or–L, 0.173–0.209 (0.190, excluding sinus)
Se–Or–L, 0.202–0.274 (0.246, including sinus)
Se–OR–W, 0.173–0.202 (0.189)
Pe–D, 0.259–0.360 (0.317)
ZC–H, 0.389–0.619 (0.475)
ZC–W, 0.490–0.590 (0.539)
Ly–L, 0.022–0.036 (0.025)
Ly–W, 0.036–0.050 (0.044)
FW–T, 0.216–0.346 (0.277)
LW–T, 0.043–0.072 (0.061)

ZOARIUM: The zoarial surface is a pale buff. The heavy, sturdy zoarium is encrusting, unilaminate, tending sometimes to several layers in thickness when zoids overgrow an older layer. Where a second layer grows over another layer of this species the new layer neglects to put in its own dorsal wall but uses the frontal wall of the underlying layer as a back for its new zoids. No soft polypide parts are in the material. The few pieces found fragment easily.

ZOOECIA: The zooecia are large, long and boxlike. A thin, faintly salient rim outlines zooecial boundaries here and there, most frequently around the orifice. Zooecial boundaries are also marked by marginal pores that are slightly larger than the other frontal pores, which are quite uniform in size and distance from each other.

The frontal is a thick tremocyst, its external surface dusted over with buff.

The thick lateral and end walls are perforated by pore plates (pl. 23,B). The lateral walls have 6 to 8 of these. Livingstone's specimens had 5 to 7. Some of these pore plates are punctured by 4 to 7 smaller pores. The back and front walls are gently convex but the latter sometimes flatten out completely except for the pores and the raised orifice. The side walls are straight.

AVICULARIA: Only one kind of avicularium, the oral, is present. It is visible only in dissected zoids or at the broken ends of the colony as it is small and too deep within the peristomie to be seen from the outside. Moreover, it is located back of the narrow sinus and obliquely oriented. No mandibles are in the present material, but Livingstone describes them as being rounded-triangular.

ORIFICE: The orifice is nearly terminal. The frontal of the next distal zoid helps to form its distal wall (pl. 23,C,D). Its sides are in contact with frontal extensions from the neighboring rows of zoids. The orifice is elevated above the rest of the frontal surface. The primary and secondary orifices look quite different, the secondary

being clithridiate (pl. 23,C,D), the primary smittinoid (pl. 23,E,F,H). The primary orifice cannot be seen from the outside except in damaged or dissected zoids because of the depth of the peristomie (pl. 23,B,E,G). No opercula are in the present collection. The small toothlike lyrula and cardelles are firm and sturdy.

Ovicells: None has been found to date.

Distribution and Ecology: A small amount of old material, including the holotype (USNM 11312), came from Station 44 (lat. 65°25′ S., long. 101°13′ E.). Part of it grew on a reteporid bryozoan. In turn, over it grew *Lacerna hosteensis*, *Microporella trinervis*, *Mucronella crozetensis*, *Smittoidea ornatipectoralis*, *Smittina canui*, *Microporella* sp., sponge, and Foraminifera.

This species has been previously reported under the name of *Porella malouinensis* by Livingstone (1928, pp. 9, 68) from lat. 66°32′ S., long. 141°39′ E., at 157 fathoms. Vigeland (1952, pl. 3, fig. 1) apparently had the correct *Porella malouinensis* of Jullien (1888) but included Livingstone's above-named species in his synonymy.

Affinities: *Porella malouinensis*, as pictured and described by Jullien (1888, p. 57, pl. 3, fig. 6), is a *Smittina*, with a good-sized elliptical oral avicularium placed centrally in the wide sinus of a large orifice. Its mandible is directed more or less forward. Also, the peristomial sinus is wide enough and the avicularium is so close to the edge that the avicularium can be readily seen without tilting the zooecium. The specimen that Livingstone identified and pictured as *Porella malouinensis* is really *Smittina abditavicularis*, new species. In *S. abditavicularis* the sinus is very narrow and the orifice is small and deep; therefore, it is extremely difficult to see the avicularium or even suspect its presence without much specimen-maneuvering and hunting for cross or end sections. Moreover, the avicularium is very small and obliquely directed in the center of the peristomie instead of being turned directly outward. Also it is more oval than rounded. Jullien did not describe the lyrula, cardelles, or shape of the primary orifice. Without such data or without a picture of these parts it is difficult to identify some of the Smittinidae. Finally, Jullien (p. 57) described the *P. malouinensis* ovicell as hemispherical, granular around the periphery, and bearing a group of punctae on the flattened surface. Neither Livingstone's nor the present author's specimens had ovicells.

Smittina alticollarita, new species

Plate 24

Diagnosis: Zoarium white, encrusting. Zooecial frontal a gently convex, thick, roughly granular tremocyst. Thin salient mural rims.

Frontal pores rounded, medium sized, spaced fairly well apart. Trisectional peristomial collar sometimes flares out excessively. Peristome with fair-sized sinus in which is set a broadly oval avicularium. Avicularia set at an angle against the frontal, with broader end proximal. Lyrula medium sized. Tall ledges (cardelles) extend high, halfway up the primary orifice sides, separated from the lyrula by a sinus. Ovicells, opercula and mandibles unknown.

Smittina alticollarita is named for its excessive, elevated, flaring collar or peristome, from the Latin "altus" (high) and "collaris" (collar).

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 721).

Z–L, 0.864–0.936 (0.889)	Pr–Or–W, 0.173–0.187 (0.176)
Z–W, 0.504–0.619 (0.573)	Se–Or–L, 0.158–0.216 (0.177)
Av–L, (0.072, four readings)	Se–Or–W, 0.158–0.202 (0.174)
Av–W, 0.058–0.065 (0.061)	Ly–L, 0.029–0.036 (0.030)
Pr–Or–L, 0.122–0.130 (0.128)	Ly–W, 0.058–0.072 (0.061)

Zoarium: The white, smooth-textured, fine-patterned holotype colony is 9 mm. by 10 mm. and consists of about 100 hexagonal zooecia which are large enough to see with the unaided eye and which form a thick-walled heavy crust on the substratum. The zoarium is without mandibles, ovicells, or soft polypide remains.

Zooecia: The zooecial frontal is a gently convex tremocyst, more often roughly granular than beaded, although both textures may occur on the same zoid. The frontal pores are rounded, of uniform size, fairly well spaced from each other, the peripheral pores being no larger than the more central ones. The mural rims are thin salient threads. The most elevated part of the frontal is the peristome.

Avicularia: Present in some zooecia and absent from others. Although few are present they appear to be of uniform size and in the same location. They are placed neither vertically nor horizontally but at an angle to the frontal, in the gap formed by the two approaching ends of the peristomial collar. Their proximally directed beak is longer than the membranous avicularial back area. The mandible, judging from the shape of the beak, should be thumb-nail shaped.

Orifice: The orifice is frontal. Its distal wall is formed with the aid of the next distal zoid. The peristome is raised distally, in the young zoids like a head shawl (pl. 24,C). It shows considerable variation in the same colony (holotype)—from the simple thin collar through various intermediate stages (pl. 24,A,D,F) to a 3-lobed moderately thickened elevated collar (pl. 24,B). There is even a higher peristome on an old, 2-zoid paratype (pl. 24,E).

The secondary orifice is pear shaped, the sinus being the narrower part. The medium-wide proximal sinus is really an interruption in the peristome where the avicularium, if present, is placed.

The primary orifice is smittinoid, its distal half a wide low arc, its sides narrowed by tall palisade ledges or cardelles, its proximal wall with a distinct, squared lyrula separated on each side from the cardelles by a medium-sized sinus. The lyrula is only a short distance from the oral avicularium and peristomial sinus and can be easily seen from the outside, thus differing markedly from *Smittinella rubrilingulata*, whose lyrula is buried deep in the orifice.

The operculum is delicate, only lightly chitinized around the rim.

Features making this species distinct from others of the *Smittina* in the collection are the height of the cardelles compared with the lyrula and the considerably elevated, petallike, trilobate peristome.

Ovicells: Unknown.

Distribution and Ecology: Both the holotype (USNM 11316) and paratype are from Station 44. The former consists of about 100 zoids and encrusts a reteporid bryozoan which, in turn, is growing over a colony of *Emballotheca phylactelloides*. A calcareous worm tube, a hydroid stalk, and Foraminifera grow over the *Smittina*. The paratype is an old ivory-colored scrap of two zoids.

Affinities: The absence of an ovicell makes determination of relationships a bit difficult. However, in the form of the excessively developed peristome this species resembles *Peristomella monstruosa* Kluge 1946 but differs from it in having a tremocyst, while *P. monstruosa* has a solid nonporous frontal (pleurocyst?). *Smittina alticollarita* resembles Osburn's (1952, pl. 47, fig. 1) specimen of *Smittina landsborovii* as to aperture shape but the avicularia of the two species are different. Also, *S. alticollarita* has a more elevated, petallike peristome. Jullien (1888, pp. 54–55, pl. 2, fig. 4) described a *Smittia purpurea* which has a porous frontal, raised mural rims, and a pronounced peristomial collar, but its avicularium differs from that of *Smittina alticollarita* in being within the peristomial boundaries, enclosed by the peristome frontally. Brown (1952, p. 323) comments that Jullien's *S. purpurea* is not the *S. landsborovii* var. *purpurea* of Hincks, 1881.

Smittina canui, new species

Plate 25

Diagnosis: Zoarium encrusting. Zooecial frontal wall a tremocyst with many medium-sized pores. Raised peristome interrupted proximally by a small elliptical oral avicularium. Mandible tongue shaped. Secondary orifice shaped like a sector of a circle. Primary orifice smittinoid, with broad low lyrula and cardelles. Ovicell thick, globose, and perforated by many medium-sized pores.

This species is named in honor of Dr. F. Canu who, in collaboration with Dr. Bassler, produced a number of excellent bryozoan monographs that have been of immense service to all present-day bryozoologists.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.778–1.080 (0.962)	Se–Or–L, 0.127–0.158 (0.143)
Z–W, 0.504–0.734 (0.638)	Se-Or–W, 0.144–0.173 (0.158)
Av–L, 0.058–0.094 (0.074)	Ly–L, 0.017–0.029 (0.024)
Av–W, 0.043–0.058 (0.054)	Ly–W, 0.086–0.101 (0.093)
M–L, 0.029–0.050(0.040)	Ov–L, 0.288–0.360 (0.318)
M–W, 0.029–0.037 (0.035)	Ov–W, 0.331–0.403 (0.360)
Pr–Or–L, 0.101–0.130 (0.118)	Op–L, 0.115 (Only one)
Pr–Or–W, 0.171–0.187 (0.177)	Op–W, 0.173 (Only one)

ZOARIUM: The encrusting zoarium grows over other Bryozoa. It is white, shiny, and rather smooth. The zooecia are large enough to see with the unaided eye.

ZOOECIA: Large, longer than wide and mostly hexagonal, with walls more gently curved than angular. Zooecial boundaries are usually distinct. A slim, slightly raised mural rim is often present (pl. 25,D,E), but due to the convexity of the frontal surface these are pushed down into the "valleys" at the sides of the zooecia so that they are at a lower level than the rest of the frontal. The frontal is a fairly thick tremocyst, punctured by numerous medium-sized rounded pores placed relatively equidistant from each other. The frontal between the pores is granular or beaded. The most elevated part is the peristome, which is very similar in side view to that of *Smittina ordinata*.

The lateral and back walls are thinner than the frontal. Where a few zoids are free from the substratum the back walls appear gently convex and entire. The lateral walls have five or six multiporous pore plates in a line near the base. The distal walls also are porous. One zoid had three plates that were not as large as the side-wall pore plates.

AVICULARIUM: No avicularia other than the oral ones are present. Every zoid has them, except the very youngest which have not yet completed growth.

The small elliptical avicularium is cradled in the depressed incomplete part of the peristome. It is tipped forward and downward by a small curved ledge or hillock (pl. 25,K) so that it is situated roughly a 45° angle away from the dorsal surface, along the longitudinal axis. The mandibular part is longer than the subhemispherical membranous area. The mandible is tongue shaped, with parallel sides and a curved tip.

ORIFICE: The elevated orifice is nearly terminal. No oral spines are in the present colonies. The secondary and primary orifices are different in shape. The former is somewhat like the sector of a circle; plate 25,B is most typical of it. It is less clithridiate than that of *S.*

ordinata and *S. alticollarita*. Its curved distal third is formed by the frontal wall of the next distal zoid. The other two sides may be straight in young zoids, or curve inward in older zoids, depending upon the thickness of the growing, encroaching peristomial walls. The primary orifice is smittinoid, wider than long, with a wide low lyrula and fairly prominent cardelles that sometimes show and sometimes do not. Few opercula are present. Between the primary and secondary orifices is the small oral avicularium.

Ovicell: The ovicells are globose, moderately salient and thick-walled. They are met at the sides by the heightening peristome (pl. 25,E). They are punctured by pores similar to those of the zooecial front. The pores are over most of the ovicell surface, not restricted to a central porous area that Busk (1884, p. 151) describes for *S. smittiana*, a closely related species. The ovicell is comparatively large.

Distribution and ecology: Only three fragments of partial colonies are in the collection. A paratype from Station 226 measures 4 by 7 mm. The holotype (USNM 11304) from Station 44 is growing over a retepore, in close proximity to a colony of *Smittina excertaviculata*. Another specimen from Station 44 is growing partly over *Microporella trinervis*, which in turn is supported by other bryozoan species (*Smittina oblongata* and the retepore). This patch measures about 10 mm. by 36 mm. and represents the growing edges of possibly two colonies.

Affinities: This species resembles *S. smittiana* Busk (1884, p. 151, pl. 17, figs. 3,3a,3b) in the following ways: Both have a wide low lyrula (some differences however); primary and secondary orifices of both species agree; both have an oral avicularium enclosed within the peristome; both have a tremocyst; and the zooecial width is the same in both although the length of some of Busk's specimens appears to be twice that of mine.

The two species differ in the following ways: Shape and relative size of the oral avicularium; extent of perforation of the ovicell; and occurrence of salient mural rims in *S. canui*, sometimes encroaching upon or over the ovicell, but not in *S. smittiana*.

Busk (1884, p. 151) gives an ambiguous account of the lyrula and does not figure it. Canu and Bassler (1920, pp. 458–459, fig. 132m) picture it but their figure also reveals an oral avicularium which is proportionately much smaller with respect to the lyrula than is true for *S. canui*. Busk describes the avicularium as round, but that of *S. canui* is longer than wide. The avicularium figured by Canu and Bassler also is longer than wide. In *S. canui*, the ovicell is perforated all over, while in *S. smittiana* the perforations are restricted to a reni-

form or oval area on the front. Busk obscurely describes five converging triangular openings within the reniform area but does not picture them on the ovicell in his figures 3a and 3b. Nothing comparable to them is present in *S. canui*. Moreover, the ovicells of the latter appear to be much larger proportionately than do those of *S. smittiana*.

Lastly, slightly salient mural rims occur around the zooecia of *S. canui*, sometimes even encroaching partly over the ovicell front (pl. 25,E), while Busk says that his zooecia are not separated by septal ridges (mural rims).

Smittina canui at first glance might be mistaken for dead white colonies of *S. ordinata* except for the difference in the degree of ovicell perforation.

Another species showing close relationship to *S. canui* is the *Smittina landsborovii* pictured in Osburn's monograph (1952, pl. 47, fig. 2). Both have a small oral avicularium, frontal and ovicell perforated, and broad lyrula. Osburn's specimen differs from *S. canui* in the shape of the secondary orifice, thinness and shortness of peristome, and extension of peristome over the front of the ovicell.

Smittina excertaviculata, new species

PLATE 26

DIAGNOSIS: Zoarium encrusting, rather heavy-bodied. Mural rims thin, slightly salient. Zooecial front convex, punctured by numerous, closely set pores. Nonporous peristome flared laterally. Secondary aperture somewhat reniform or shaped like a horse's hoof, with an elevated, bent, spatulate avicularium set into the hilum area. Avicularium medium sized. Primary orifice with low broad lyrula and two inconspicuous cardelles. Ovicell globose, with a porous frontal area and a secondarily encrusted peripheral area.

This species is named for the projecting nature of its avicularium from the Latin "excertus" (projecting, protruding) and "avicula" (diminutive for bird).

MEASUREMENTS: The minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.818–1.079 (0.947)
Z–W, 0.539–0.835 (0.680)
Av–L, 0.086–0.115 (0.095)
Av–W, 0.058–0.086 (0.070)
M–L, 0.086 (Only one)
M–W, 0.050 (Only one)
Pr–Or–L, 0.137 (Only two)
Pr–Or–W, 0.202 (Only two)
Se–Or–L, 0.158–0.259 (0.216)
Se–Or–W, 0.212–0.245 (0.217)
Ly–L, 0.029–0.033 (0.030)
Ly–W, 0.072–0.102 (0.095)
Ov–L, 0.288–0.403 (0.349)
Ov–W, 0.317–0.374 (0.340)

ZOARIUM: The ivory-colored calcareous zoarium grows over other bryozoan species as well as its own kind.

Zooecia: The more or less hexagonal zooecia are rather heavy-bodied, i. e., thick-walled. A faintly raised mural rim outlines the gently convex frontal wall. Where the frontal wall bulges more prominently, the mural rims lose their salient appearance and slope gradually down to meet the walls of the neighboring zoids, thus forming a "valley" between zoids. The frontal wall is punctured by numerous, evenly spaced pores set closely together everywhere except in the peristomial region. The slightly beaded peristome rises above the rest of the frontal, flaring outward and interrupted or straddled by the peristomial or oral avicularium.

Avicularium: Only one type—the medium-sized, peristomial, spatulate type—occurs. It is always present and in the same location, set in the middle of the peristomial proximal rim. The spatulate mandibular section is larger and bent at the pivot or cross bar in a different plane than the smaller subhemispherical back avicularial area (pl. 26,A,E,G). The spatulate mandible has a basal and peripheral chitin reinforcement (pl. 26,G). The avicularial chamber is placed between the lyrula and the peristome. The two planes of the avicularial surface (the mandibular and back areas) are both at varying slants with respect to the plane of the zooecial frontal, so the avicularial surface is bent or bevelled.

Orifice: The primary orifice is well hidden by the projecting peristome and avicularium. It has a low, medium-wide lyrula and cardelles (pl. 26,B). The peristomie or passageway between the primary and secondary orifices is long and somewhat reniform on end because of the avicularial chamber. The proximal half of the peristome often appears slightly wider than the distal half. The side walls sometimes pinch inward medially to give the secondary orifice an almost trifoliate appearance. The distal peristome wall is made up largely from the wall of the next zoid in the series (pl. 26, A,B). In ovicelled zoids the lateral peristome walls grow upward onto the sides of the ovicell. No opercula were found.

Ovicell: Few ovicells are in the colonies. They are globose, salient, smooth frontally, and punctured by about 16 casually distributed elliptical or oval pores over the thin smooth frontal area. The periphery of the ovicell is a bit thicker, rougher and crusty.

Distribution and ecology: The holotype (USNM 11314) is from Station 45 and consists of a scrap of about three dozen zoids, some overlapping others, growing around a stalk of "*Smittia*" *inclusa* Waters 1904 (=*Clithriellum inclusum*). The paratypes consist of more zoids encrusting other Bryozoa (a retepore, *Mucronella crozetensis*, and *Smittina abditavicularis*) from Station 44. No soft polypide parts are in the specimens.

Affinities: *Smittina excertaviculata* is like the fossil Australian species *Porella punctata* MacGillivray (1895, p. 91, pl. 12, figs. 8, 10, 11) in the shape and general appearance of the secondary orifice but differs from it in having a much more densely punctured frontal. In this respect, *S. excertaviculata* resembles another fossil, *Smittia cribraria* MacGillivray 1885 (1895, p. 93, pl. 12, figs. 16–17), but differs from this earlier species in the shape of the secondary orifice. Ovicells were unavailable for description in both fossil species. *Smittina excertaviculata* thus seems to be more closely related to the Australian fossil forms than to more recent species.

Smittina obicullata, new species

Plate 27

Diagnosis: Colony unilaminate to bilaminate, encrusting or erect, forming broad blades. Zooecial frontal gently convex or flattened except for the frontally projecting peristome and elevated suboral avicularium. Frontal sometimes granular, perforated by numerous pores. Mural rims thin and salient. Secondary orifice outlined by a partial peristome, raised highest in front and less at sides. Peristome broadly notched medially. Primary orifice broadly curved, wider distally. Two cardelles and a low, broad, truncated lyrula. A small, rounded to elliptical avicularium below peristomial notch in some zoids. Mandible nearly hemispherical, with a pair of converging sclerites. Ovicell thin-walled, smooth, globose, punctured by several pores and encroached upon by the peristome and neighboring zoids at the sides.

The name of this species derives from the Latin "obicis" (barrier, bar, wall) and "ulus" (diminutive) because of the peristome, which forms a small barrier or wall in front of the primary orifice.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.864–1.101 (1.001)
Z–W, 0.418–0.518 (0.446)
Ov–L, 0.274–0.317 (0.295)
Ov–W, 0.288–0.360 (0.347)
Av–L, 0.144–0.173 (0.159)
Av–W, 0.115–0.144 (0.134)
M–L, 0.072–0.101 (0.094)
M–W, 0.079–0.122 (0.104)
Pr–Or–L, 0.144–0.173 (0.152)
Pr–Or–W, 0.173–0.230 (0.202)
Se–Or–L, 0.158–0.230 mm. (0.193 mm.)
Se–Or–W, 0.202–0.259 (0.237)
PN–L, 0.050–0.122 (0.084)
PN–W, 0.043–0.086 (0.066)
Ly–L, 0.022–0.029 (0.027)
Ly–W, 0.058–0.086 (0.073)
Op–L, 0.209–0.223 (0.216)
Op–W, 0.122–0.144 (0.131)

Zoarium: Zoaria a dull ivory or grayed buff color and up to 3.5 by 4 cm. in size. They form broad-bladed bilaminate chips after arising from the unilaminate encrusting (substratum) layer. The

colony texture is rather smooth but has a faintly embossed surface where ovicells occur in rows or patches. The thickness of a bilaminate blade is from 0.547 to 1.08 mm. (average 0.772 mm.).

Zooecia: The zooecia are of four types, those with or without ovicells and those with or without avicularia. Both some of the ovicelled and some of the nonovicelled zoids have suboral avicularia; others lack them. The zooecia are 4- to 6-sided, longer than wide and faintly outlined by their thin salient mural rims. The frontal surface looks like a coarse woven mesh because it is perforated by numerous, large, closely set pores and is also pebbled between the pores. It is flattened to gently convex except in the peristome and avicularial regions, which protrude or are elevated. The frontal wall is thicker than the side and back walls. The side walls are perforated by about six large pores.

Avicularium: Only one type of avicularium, the suboral, is present. It may be lacking in about half the zoids of some colonies. There is never more than one per zoid. When present, these broadly elliptical to nearly rounded avicularia always occur in the same position and orientation—in the midline, immediately below the peristomial sinus, with the mandible pointing proximally. The area back of the cross bar and mandible is very short and curved. The mandibular area and mandible are a bit longer than a hemisphere. The avicularium is elevated above the general frontal surface. The mandible is parallel with the frontal surface but the back area may in some instances slant downward, distally. The mandible has two converging sclerites (pl. 27, E).

Orifice: The orifice is at the extreme frontal-distal edge of the zooecium. Its distal border is the wall of the next neighboring zoid. The secondary orifice is bordered by a partial peristome. The primary orifice is deeper. The peristome is mostly frontal. It consists of two more or less elevated and prolonged tabs or processes between which is located the wide sinus or notch. The tabs are sometimes parallel, sometimes almost meeting at the tips (pl. 27,C). As a result, the sinus is sometimes fingerlike, sometimes nearly circular. The peristome projects outward at an angle from the frontal surface, like the spout of a pitcher. The secondary orifice is more or less hemispherical distally and deeply sinuate proximally, roughly resembling the side view of a mushroom. The primary orifice is broadly curved distally and provided with a wide low truncated lyrula and two cardelles proximally. It is wider distally than proximally. The chitinous operculum is rather thin and delicate. Two curved lateral sclerites, one on each side, serve for muscle attachment (pl. 27,D).

Ovicell: The smooth, thin-walled ovicells are globose but not excessively salient. The peristome and neighboring zooecia encroach upon their sides. The frontal wall of the ovicell slopes down into the orifice and forms a straight line across the upper part of the orifice. The distal half of the ovicell wall is punctured by up to about 15 medium-sized pores.

Distribution and ecology: The holotype (USNM 11300) is from Station 190. Other colonies are from Stations 226 and 234. Polypide remains are in some of the zoids. Diatoms, Foraminifera, sponges, hydroids, sandy worm tubes and Bryozoa are found on some of the colonies.

Affinities: *Smittina obicullata* is similar to *Smittia monacha* Jullien (1888, pp. 52–53, pl. 2, figs. 1–3) and *Smittia jacobensis* Busk (1884, p. 153, pl. 19, figs. 7a,b) but differs from them in the shape of the secondary orifice, the direction (location) from which the approximating peristomial processes originate, and in the precise location of the avicularium. Its secondary orifice is shaped like a mushroom or shovel, while that of *S. monacha* is more or less circular, and that of *S. jacobensis* is elongate, like a vertical row of parentheses. In both *S. monacha* and *S. jacobensis* the peristomial bridge originates from the sides (lateral walls) of the peristome, while in *S. obicullata* it originates from the proximal wall. Lastly, in both *S. monacha* and *S. jacobensis* the peristomial bridge formed by the approximating tabs arches directly over the partly hidden avicularium like a bridge spanning water, while in *S. obicullata* the avicularium is exposed to full view outside the peristomial boundaries and the "bridge" arches over the peristomial sinus distal to the avicularium.

Smittina oblongata, new species

Plate 28

Diagnosis: Zoarium encrusting. Zooecial front gently convex and decorated by small, widely and irregularly spaced pores. Collar-like peristome is interrupted by a deep, wide, median, angular notch inside of which is a wide, truncated lyrula bordered by two wedge-shaped lateral cardelles. A thin salient edge outlines zooecial boundaries. Immersed ovicells with a few irregular pores present. Some zooecia with a long narrow spatulate suboral avicularium medially and longitudinally placed just beneath (almost touching) the peristomial notch. Beak proximal. Zooecia rectangular.

This species was named *S. oblongata* because of its very long, narrow avicularia and zooecia, from the Latin "oblongus" (somewhat long, oblong).

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 721).

Z–L, 1.440–1.92 (1.744)
Z–W, 0.440–0.520 (0.488)
Av–L, 0.331–0.360 (0.350)
Av–W, 0.115–0.130 (0.129)
B–L, 0.259–0.266 (0.265, three readings)
Se–Or–L, 0.173–0.230 (0.203)
Se–Or–W, 0.187–0.216 (0.206)
Pr–Or–L, 0.144–0.173 (0.153)
Pr–Or–W, 0.202–0.216 (0.215)
Ly–L, 0.029–0.043 (0.032)
Ly–W, 0.101–0.122 (0.110)

Zoarium: Ivory-colored, flat and smooth. One colony fragment appears to be bilaminate.

Zooecia: A thin salient edge outlines the boundaries of the long, narrow, boxlike zooecia. Various kinds of zooecia are present: ovicelled, nonovicelled, and those with or without avicularia. The raised, collar-like peristome is the most elevated part of the zooecial front. The frontal wall is slightly convex and much thicker than the flat lateral and back walls. It is a tremocyst perforated by small, irregularly scattered and widely spaced pores, not areolate in nature. Deviations from this condition occur in some zooecia through greater calcification, which leads to an almost complete obliteration of the pores or to a roughening of the frontal surface by low bumps, closely set together. Lateral walls are punctured by four or five large pores. The proximal wall has two pores.

Avicularium: Not all zooecia have avicularia. In one colony only 3 out of 29 zoids had avicularia. Not more than one occurs per zoid. All the observed avicularia are of one type, long, narrow, spatulate; and in one location, suboral, external, median. They are oriented with the mandible pointing proximally, are placed close to the peristomial notch, and are rounded at both ends. Their long sides are parallel. Their proportion of length to width is almost 3:1. No mandibles are available.

Orifice: The orifice is practically terminal, at the distal-frontal edge of the zoid. A raised peristome arches about three-fourths of the way around the opening. The other fourth is the notch or interruption in the peristome. Deeper within the peristomie is the primary aperture.

The secondary aperture is nearly circular, except for the notch or gap. The peristomial wall is formed cooperatively by its own and adjacent distal zoid (pl. 28,G). The primary orifice is smittinoid, gently arched distally; proximally it has a wide low median lyrula, some distance to each side of which is a wedge-shaped cardelle.

Opercula unobserved.

Ovicell: Only two easily distinguishable ovicells are in the samples. They are somewhat flattened, globose, and perforated by a few irregular pores. They did not have an avicularium suborally, but whether this is a constant or variable feature cannot be determined because of lack of material.

Distribution and ecology: Station 44 yielded the holotype (USNM 11311) and a few other colony fragments without soft or chitinous parts. No other species were growing over them.

Affinities: This species is similar to *Smittia antarctica* Waters (1904, pp. 65–66, pl. 4, figs. 1a–h). It differs from Waters' species chiefly in the location of the avicularium. Waters pictures the avicularium a considerable distance away from the orifice, while in *S. oblongata* the avicularium is close to the peristomial notch—in fact intrudes upon it (pl. 28, C). Also, the interior of the avicularial beak seems to be different in the two forms. No opening is shown in the apparently flat floor of the beak in Waters' species, while there is a sizable opening and a keeled floor in *S. oblongata*. A third point of difference is in the number of lateral wall pores. Waters mentions 10 pore plates while *S. oblongata* has 4 or 5. A fourth point of difference is in the shape of the zooecia. Waters' specimens are hexagonal, while those of the current species are rectangular. This may not be a very important difference since so little material is available.

Smittina ordinata (MacGillivray)

Plates 29, 30

Smittia ordinata MacGillivray, 1895, p. 93, pl. 12, figs. 18, 18a, 19.

Diagnosis: Zoarium small, encrusting. Zooecial frontal convex, granulated to beaded and punctured by numerous evenly and closely set pores. The short heavy peristome interrupted frontally by a notch that cradles the small oval to almost round oral avicularium. No other avicularia. Mandible spatulate. Up to four transitory spines about the orifice in only the very youngest zoids. Secondary orifice clithridiate. Primary orifice with weak lyrula and cardelles. Globose granulated ovicell, punctured by a pore near the midregion (and an occasional peripheral pore), but pores may be obliterated by advancing calcification, which also flattens the ovicells, and the frontal.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.547–0.893 (0.668)
Z–W, 0.353–0.504 (0.388)
Av–L, 0.058–0.086 (0.075)
Av–W, 0.046–0.058 (0.056)
Pr–Or–L, 0.086–0.101 (0.095)
Pr–Or–W, 0.137–0.147 (0.142)
Se–Or–L, 0.144–0.173 (0.153)
Se–Or–W, 0.122–0.144 (0.137)
Ly–L, 0.022–0.029 (0.023)
Ly–W, 0.043–0.072 (0.054)
Ov–L, 0.230–0.259 (0.249)
Ov–W, 0.259–0.288 (0.271)
Op–L, 0.092–0.096 (two readings)
Op–W, 0.138–0.173 (two readings)
M–L, 0.036–0.055 (0.050)
M–W, 0.036–0.050 (0.043)
CS–L, 0.317–0.374 (0.340)
CS–W, 0.295–0.432 (0.356)
OS–L, 0.216
OS–T, 0.014

Zoarium: The colony forms a flat, nearly circular crust on rocks and other surfaces. Its color varies from dull tan to rose to pale lavender and occasionally even a dull green. The color may vary even in the same colony. The color is due to the thin film of organic matter that covers the otherwise white calcareous skeleton. The largest colony, from Station 240, measures 12 by 15 mm. and has more than 600 zoids. The convex frontal of the zoids gives a young colony a gently mammilated surface. The surfaces of older colonies are flattened by secondary calcification that reduces the saliency of the ovicells and zooecial frontals. The surface pattern is relatively fine and quite regular. Chitinous parts (opercula and mandibles) are present but ovicells are empty and polypides are absent.

Zooecia: Are 4-, 5-, or 6-sided. Those which begin a new radiating row are wedge shaped or 3-sided. In the very young zooecia the mural rim may be slightly salient in places but it generally sinks down to form a valley between zooecia whose frontals rise convexly. These valleys become shallower as the colony ages and secondary calcification sets in.

The thick zooecial frontal is a beaded or granular tremocyst. Its pores are medium sized, rounded, numerous, fairly close together, and rather evenly distributed. No conspicuous areolae are present, although occasional edge pores are slightly larger than the more central ones, particularly in the vicinity of the ovicell. An umbo or mucro is lacking. The compensation sac occupies most of the inner frontal surface. The peristome and ovicell are the most elevated parts of the frontal surface and are thin in young zoids, thick in old ones. Only rarely are peristomial spines found on any zoids, and then only on a few very young marginal ones. They are delicate, long, hollow, hyaline, and 2–4 in number.

Avicularia: Small oval avicularia occur within the peristomes of all zooecia and are the only type present. They are lodged within the peristomial notch at approximately a right angle to the longitudinal zooecial axis. Their spatulate mandibles are chitinized as shown in plate 29, I–L.

Orifice: The clithridiate or pear-shaped secondary orifice is nearly terminal and surrounded by a medium high, thick-walled peristome. The distal peristome wall is formed from the walls of the next distal zooecium. The lateral peristome walls are formed by its own zoid. The peristome is interrupted frontally by a sinus in which nestles the oral avicularium. An anomaly, the presence of two oral avicularia within the peristomie of two nearby zoids, occurred in a colony from Station 240. Because of the convergent nature of the peristome walls, the primary orifice is difficult to see. The wider-than-long primary orifice has a medium-sized, weak, low lyrula and two prominent car-

delles generally, but variations occur even in the same colony as regards the prominence and width of the lyrula and the presence or absence(?) (at least the visibility) of the cardelles. The cardelles are two small blunt pegs placed some distance from the lyrula, at the lower corners of the orifice. However, it is not possible to see them in all orifices. Whether they are absent or just directed inward, out of sight, could not be determined without damaging the colonies.

The operculum is considerably wider than long. Its distal arch is broad and low, being much wider than the proximal border, which is drawn out into two chitinized points from which a reinforced edge continues distally.

Ovicell: Numerous ovicells are present. Young ones are gently salient, globose, and provided with a membrane-plugged central pore, while older ones are practically level with the frontal surface of the next distal zoid. Their surfaces are gently beaded or granular. Nearly half of the ovicells have a single small oval frontal pore, variously placed—sometimes centrally, sometimes more distally or laterally. A few ovicells in the same colony may have an occasional extra, smaller, irregularly placed pore. The remaining ovicells in a colony may lack the central pore because advancing calcification has obliterated it. Some of the ovicells are bordered by a few large pores that are a part of the frontal surface of the surrounding or next distal zoid. In summary, the commonest ovicell frontal condition in a well calcified colony is either solid or punctured by a single pore. In old colonies there is a fusion of the frontal layer of the ovicell with the frontal of the next zoid, so there is no outward sign of demarkation between the two except that the zooecial frontal is uniformly porous while that of the ovicell is not.

In a young colony of only about 50 zoids, growing on the back of a *Phylactella lyrulata* colony from Station 226, ovicells already had made their appearance, indicating that early sexual reproduction occurs in this species. This colony also had a zoid with two peristomial spines.

Distribution and ecology: A few small colonies were taken from Stations 104, 184, 226, 240 and Rock 6 (station unknown). They grew on various substrates: stones or pebbles as Rock 6 and Stations 184, 226, 240; Alcyonaria spicules at Station 226; other Bryozoa at Station 104, and *Phylactella lyrulata* at Station 226.

Affinities: It is with some hesitation that these Antarctic specimens are assigned to the same species as MacGillivray's Australian fossil species (*S. ordinata*) originally described from Schnapper Point, Muddy Creek, and Moorabool deposits whose age is variously given as Eocene, Oligocene, or early Miocene (MacGillivray, 1895, p. 2). Following is an abridged version of MacGillivray's (p. 93) description of *S. ordinata*: "Zooecia . . . separated laterally by deep furrows . . .

thyrostome somewhat pyriform with a rounded sinus below; a quadrate median denticle, having in front a small avicularium within the lower edge of the peristome. Ooecia small, rounded, subimmersed in the zooecium above." His ovicell apparently is imperforate (pl. 12, fig. 19) or, at most, provided with only occasional pores (if three shaded spots on the sketch can be interpreted as pores). He also omits mention of the shape of the avicularium and mandible and gives no measurements.

The Antarctic specimens are in closer agreement with the Australian fossil form than with recent species. Six recent species with which it might be confused because of the ovicell or possibly other features are *Porella concinna* (Osburn, 1910, pl. 27, fig. 67a; cf. comment in his 1933 paper, p. 46, on this species), *Porella purpurea* (Canu and Bassler, 1929, pl. 43, fig. 1), *Schizoporella perforata* (Canu and Bassler, 1929, pl. 35, fig. 9), *Smittina bella* (Osburn, 1952, pl. 47, fig. 5), *Smittina novanglia* (Osburn, 1933, pl. 13, figs. 7, 8), and *Stomachetosella sinuosa* (Osburn, 1952, pl. 34, fig. 3).

Accounts of two other species gave the writer much difficulty during the identification of *S. ordinata*. They are *Smittia graciosa* Busk (1884, p. 154, pl. 22, fig. 13) and *Porella concinna* Hincks (1880, pp. 323–326, pl. 46, figs. 7, 9, var. *gracilis*). Busk's *S. graciosa* sample was without ovicells and their absence in his description was a stumbling block. Hincks' *P. concinna* is an assemblage of several species that are impossible to sort out without adding further confusion.

Genus *Smittinella* Canu and Bassler, 1934

Smittinella Canu and Bassler, *in* Bassler, 1934, p. 408 (genus defined).—Bassler, 1935, p. 202; 1953, p. G209.—Brown, 1952, p. 333.

Remarks: Canu and Bassler erected the genus for those species of *Smittina* having a tremocyst and a "deep vertical proximal sinus of the peristomice which is covered by the peristome which is thus pierced by a spiramen" (Bassler, 1953, p. G209). Brown modifies the description somewhat by stating that the sinus is not always cut off or occluded by the growth of the lateral denticles. However, he believes in retention of the genus because of the deep shaftlike sinus between the primary and secondary orifices and because of the absence of frontal avicularia from the sinus. *Eschara tatei* Tenison-Woods (1877, p. 149, fig. 15) is given as the genotype by both Bassler and Brown.

It is with some hesitancy that the Antarctic specimen is put in this genus. However, in view of its deep, well defined peristomial groove and its lower, well hidden lyrula and primary orifice (and to date the absence of any positive avicularium) it was thought practical to list it as a *Smittinella*.

Smittinella rubrilingulata, new species

PLATE 30

DIAGNOSIS: Zoarium small, rose colored, encrusting. Zooecia convex, hexagonal, their frontal surfaces a beaded tremocyst with marginal pores somewhat larger than the other frontal pores. Depressed mural rims. A small, pointed, deeply colored process in peristomie, between the lyrula and external peristomial notch. Primary orifice deeply set, with a larger elliptical anter and a narrower, shallow poster. A medium-sized lyrula is bordered on each side by a very narrow sinus. Lyrula hidden from view by the median triangular process. Secondary orifice clithridiate. Peristome thin, elevated, collarlike, interrupted frontally by a prominent notch. Two parallel lateral peristomial ledges form a downward slanting channel between the secondary orifice and the lyrula. Ovicell beaded, globose, salient, with a single membrane-covered pore a bit above the frontal edge. No avicularia found.

The name of this species is derived from the Latin "rubra" (red) and "lingula" (diminutive of tongue), because of the deeper coloring about the triangular oral process.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.648–0.950 (0.824)	Ov–L, 0.288 (One reading)
Z–W, 0.562–0.706 (0.629)	Ov–W, 0.360 (One reading)
Se–Or–L, 0.130–0.158 (0.143)	Op–L, 0.115–0.144 (0.129 mm.)
Se–Or–W, 0.133–0.202 (0.158)	Op–W, 0.166–0.180 (0.174 mm.)
CS–L, 0.432–0.493 (Four readings)	Ly–L, 0.014–0.036 (0.026 mm.)
CS–W, 0.518–0.533 (Three readings)	Ly–W, 0.036–0.065 (0.047 mm.)

ZOARIUM: Only small colonies consisting of few zoids were found encrusting a large rock from Station 184. Colonies are lavender or rose colored and so similar in general appearance to those of young *Smittina ordinata* (MacGillivray) that it is easy to confuse them. They look lavender on the rock but rose colored when viewed by transmitted light on prepared slides. Polypide remains occur in some zooecia.

ZOOECIA: Distinct, hexagonal, and not heavily calcified. The most intensely colored part of a zooecium is the triangular-pointed process just back of the peristomial notch. This concentration of intense color is an easy and sure way of distinguishing between *Smittina ordinata* and *Smittinella rubrilingulata*, but specimens must be removed to slides for this criterion to be used.

The zooecial frontal is a very convex, beaded tremocyst with the marginal pores a bit larger than the other numerous, uniformly small, rounded, well spaced frontal pores. The frontal wall slopes up to the

elevated peristome. The mural rims are depressed or inconspicuous. Internally, the compensation sac occupies most of the frontal surface. On the basal surface, brownish membranous tubes connect neighboring zooecia (pl. 31,K), from 2 to 5 penetrating each wall of the hexagonal zoid.

Avicularia: No avicularia are present in the small amount of young material at my disposal. However, the peristome does show a deeply colored reddish triangular process between the lyrula and the external peristomial notch (pl. 31, A,C,F–I). This process is similar, except for its intense color and its sharpness, to the broader colorless ledge which supports the oral avicularia of *Smittina ordinata* and *Smittina canui*. Moreover, in one zooecium (pl. 31,I) it appears to connect with a presumable or potential avicularial chamber. However, its true nature must await examination of more material.

Orifice: The elevated orifice is frontal and surrounded by a thin collarlike peristome which is notched medially. The peristomial distal wall is distinct in the youngest zoids but in older zoids the next distal zooecium fuses with it.

The primary orifice is set so deeply inside the peristome that its lyrula is not visible easily from the outside. Consequently, one could very readily mistake this species for a *Schizoporella*. The primary orifice is wider than long, broadly arched distally, more contracted and shallower proximally. The lyrula and its two narrow bordering sinuses occupy this narrower proximal part. A pointed, deeply colored reddish process protrudes in front of and above the lyrula (pl. 31,A,C,H,I). Its point is close to the notch and visible from the outside (frontally). Its role is not clear at present.

There was not enough material for an adequate study of the operculum other than to measure it.

The chief feature which determined the placement of this species into the genus *Smittinella* is the deep channel which slopes downward from the secondary orifice to the primary orifice, parallel with the peristomial notch. Its side walls are the two ledges that reinforce the sides of the notch (pl. 31,B,C,F).

Ovicells: The only ovicell found is pictured in plate 31,D,H. It is hyperstomial, tipped slightly back and beaded. Its single frontal pore is membrane-covered and has decorated edges, thus differing slightly from those of *Smittina ordinata*. Also, the peristome gives an indication of possibly encroaching upon the frontal surface of the ovicell.

Distribution: This species is represented by several small colonies, including the holotype (USNM 11309), which encrusted a rock from Station 184 in Marguerite Bay.

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AFFINITIES: *Smittinella rubrilingulata* agrees more closely with Johnston's description (1847, p. 310), and fairly so with his figures (pl. 54, fig. 9), of his *Lepralia landsborovii* 1847 than do most of the species subsequently allocated to that elusive form. He describes the aperture (p. 310) as "somewhat prominent, oblique, patulous, unarmed, circular, situated on the proximal side, and in the center of this sinus there is usually a small mucro." In his figures the aperture appears to be much larger in proportion to the rest of the zooecia than is the case in *S. rubrilingulata*. Also, ovicells are lacking in his material. He cited the species as rare. Subsequent bryozoologists, in great and earnest respect for the early workers, have attempted to reconcile later finds and possibly a number of different species with the early descriptions; consequently, in the cases of *Lepralia landsborovii* (*Smittina*) and *Lepralia reticulata* (*Smittoidea*) the synonymy or misidentification is truly chaotic. Brown (1952, pp. 319–320) has attempted to clear up the matter of *S. landsborovii* by reexamination of museum material, selection of a neotype, and a redefinition of the species. Johnston did not mention or figure either the ovicell, avicularium, or lyrula (if such were present in his material)—three very essential features in the accurate determination of a smittinid species. Brown has added these features to the revised description. *Smittinella rubrilingulata* does not agree with Brown's description of *Smittina landsborovii* in regard to its ovicell and also because an oral avicularium has not yet been found. Moreover, the primary orifice and peristomial channel of *S. rubrilingulata* are distinctive or unusual features, hence it was thought best to make the Antarctic form a new species rather than to call it another dubious *S. landsborovii*.

Genus *Smittoidea* Osburn, 1952

Smittoidea Osburn, 1952, pp. 392, 408.—Bassler, 1953, p. G209.

REMARKS: Osburn erected this genus for those *Smittinas* having an areolate granular pleurocyst, a porous ovicell, well developed lyrula and cardelles, and a median suboral avicularium that is either enclosed within the peristomial sinus or very close to it. The avicularial chamber is symmetrical, i.e., developed from an areolar pore on each side of the aperture. Osburn lists the genotype as *Smittoidea prolifica* Osburn but Bassler considers *S. prolifica* synonymous with *Lepralia reticulata* Johnston, 1847, and lists the latter as the genotype for *Smittoidea*. The illustrations of *S. prolifica* (Osburn, pl. 48, fig. 7) and *L. reticulata* (Johnston, pl. 55, fig. 10) seem to be in fairly close agreement except that Johnston's figure is quite diagrammatic or "stylized" and could fit several closely related species.

Smittoidea evelinae (Marcus)

PLATE 32

Smittina evelinae Marcus, 1937, pp. 109–110, pl. 22, figs. 58A,B.
Smittina acaroensis Brown, 1952, pp. 329–331, fig. 253 (not synonymy).

DIAGNOSIS: Zoarium chalice or trumpet shaped. Zooecial frontal convex, bordered by one or two rows of areolae and a salient mural rim. A few small pores outline the umbo which bears the small rounded median oral avicularium. Avicularium perpendicular to the zooecia frontal plane, at right angles to the longitudinal axis; semicircular mandible directed forward. No avicularia located elsewhere. Two prominent lateral cardelles separated from the low medium-sized lyrula by a broad sinus. Ovicell globose, its frontal surface thin and smooth, perforated by several irregular pores; its peripheral surface granular to pebbly, nonporous, and thicker.

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.851–1.332 (1.085)	Av–L, 0.072–0.086 (0.082)
Z–W, 0.518–0.740 (0.644)	Av–W, 0.058–0.079 (0.066)
Ov–L, 0.444–0.555 (0.509)	Se–Or–L, 0.173–0.216 (0.180)
Ov–W, 0.481–0.555 (0.513)	Se–Or–W, 0.216–0.281 (0.249)
Pr–Or–L, 0.173–0.187 (0.183)	Op–L, 0.151–0.180 (0.167)
Pr–Or–W, 0.216–0.266 (0.242)	Op–W, 0.187–0.230 (0.213)
Ly–L, 0.025–0.036 (0.030)	M–L, 0.043–0.050 (0.046)
Ly–W, 0.083–0.101 (0.095)	M–W, 0.058–0.072 (0.070)

ZOARIUM: The largest colony, from Station 234, measures 56 mm. in height, 40 mm. across its widest part, and 15 mm. in its narrowest diameter. It is ivory colored, rather lightweight, brittle, thin-walled, and shaped like a trumpet or chalice. It is unilaminate, with zooecia all facing outward. Its inner (basal) surface is faintly ridged transversely and sometimes encrusted with other species. Worm tubes may be present on both frontal and back surfaces. Polypides and embryos occur in many zooecia and ovicells, respectively.

ZOOECIA: The large zooecia vary from wedge shaped to hexagonal and are bordered by a thin salient line. Their walls are thin, the thickest being the gently convex frontal. One or two rows of large, irregular areolar pores border the otherwise externally pebbled or granular frontal. The internal surface of the frontal wall is smooth and punctured by the same pores. A suddenly projecting mucro or umbo supports the oral avicularium of some zooecia but not of others in the same colony. In some zooecia of the same colony the frontal wall curves inward in this area, toward the avicularium (pl. 32,A), so that there is no umbo but the avicularium rests on this inwardly

rolled front. When an umbo is present (pl. 32,D,G,H,J) it may resemble an abbreviated spout. It is granulated, broadly rounded, with its base surrounded by a row of 3 to 6 widely spaced tiny pores (pl. 32,E).

About 5 to 7 pore plates occur in the lateral walls.

Avicularia: Only one kind of avicularium was found. It is almost always present and always in the same location, within the peristome border, median, proximal and just external to the lyrula. It is small, elliptical, and set into the peristomie in a plane vertical or at right angles to the frontal plane. Its mandible is hemispherical and chitin-reinforced both around the periphery and about the median lucida.

Orifice: The shape but not the size of the secondary orifice is different from that of the primary orifice. The secondary orifice is roughly hoe shaped—a round-cornered rectangle whose basal line sags a bit downward to accommodate the oral avicularium. The peristome is slight. The primary orifice is somewhat elliptical. Two blunt cardelles project laterally toward the medium-sized lyrula. A lightly chitinized operculum closes the primary orifice. It is wider distally than proximally.

Ovicell: The salient ovicells when seen from the front are globose. In side view their porous frontal is somewhat flattened. Their primary calcareous layer is shiny, smooth, entire except for the front face which is punctured by a number of small irregular pores. The secondary peripheral layer is thicker, rough, granular to pebbly, nonporous, and horseshoe shaped. It encroaches upon the sides and distal rim of the primary layer, leaving exposed the porous frontal area of the latter. Where the colony is heavily calcified the zoid frontal wall thickens very much as does the encircling crust around the ovicell but the perforated plate over the front of the ovicell remains fragile, thin and porous, with the yellow to brownish embryos shining through (in colonies from Station 234 especially). Raised mural rims may be seen traversing the peripheral layer (cf. pl. 32,A).

Distribution and ecology: Two large handsome colonies (pl. 32,B,I) and a few scraps came from Station 234. Smaller fragments came from Stations 226 and 230. The two large colonies had other forms growing on them or on their dorsal surface—sponge spicules, calcareous worm tubes, *Ramphonotus inermis*, *Beania*, etc.

Marcus reported the species from Isle of Palmas, Santos, Brazil, remarking that it grew on algae and solid substrates (1937, pp. 109–110).

Brown reported *S. acaroensis* (the part recorded in foregoing synonymy under *S. evelinae*) from fossil deposits collected at Castlecliff, New Zealand (1952, pp. 330–331).

Affinities: The Antarctic specimens very closely resemble in general appearance those of Brown and Marcus but differ from those of

both in general size. The length and width of the zooecia, ovicell, and operculum of the Antarctic specimens are about double the corresponding dimensions of Brown's sample. Brown's (1952, p. 330) measurements, in millimeters, are: zooecial length, 0.52–0.60; zooecial width, 0.29–0.31; orifice length, 0.17–0.19; orifice width, 0.15–0.16. Marcus does not give measurements but does include scales on the plates, and by use of these scales his material seems to have the following approximate millimeter measurements: zooecial length, 0.38–0.50; zooecial width, 0.23–0.35; ovicell length, 0.18–0.20; ovicell width, 0.23; operculum length, 0.08; operculum width, 0.11; lyrula length, 0.04; lyrula width, 0.06; mandible 0.04 by 0.08. Therefore, the Antarctic specimens would appear to be about double the zooecial, ovicell, and operculum figures of Marcus but approach closely his figures in the size of the mandible and lyrula. In both the Brazilian (Marcus') and the Antarctic specimens the median denticle or process is lacking in the cross bar (pivot) of the avicularium, but whether the denticle is an important character is uncertain. The significant difference between *S. evelinae* and Levinsen's *S. acaroensis* is in the size and orientation of the avicularium and the nature of the distal orifice border. Levinsen (1909, pl. 18, fig. 12) shows a very large avicularium apparently placed flat on the zooecial front, somewhat as in *Smittoidea ornatipectoralis brevior*, parallel to the frontal plane. But in *Smittoidea evelinae* the avicularium is smaller and placed at a right angle to the frontal plane, horizontally within the peristomial boundary, with the mandible forward. Also, the avicularium and lyrula are about the same width. Some of the inside measurements of avicularia from the Antarctic sample may even be slightly narrower than the lyrula.

Another point of difference between *S. acaroensis* and *S. evelinae* is in the nature of the distal orifice border. Levinsen pictures and cites it as serrate but in *S. evelinae* it is smooth.

MacGillivray (1895, p. 92, pl. 12, fig. 13) described a Tertiary fossil, *Porella innocua*, from Victoria, Australia, which is very similar to *S. evelinae*, differing from it only in the shape of the orifice which appears longer and more square in *P. innocua*. His figure is too vague to show the oral avicularia and he characterizes them as small.

Lastly, Kluge (1946, pl. 2, fig. 8) pictures a *Smittina glaciata* (Waters) 1900 that is very similar to *Smittoidea evelinae* in all respects except that in some zoids its avicularium may rise up on a conical peak.

Smittoidea ornatipectoralis, new species

PLATE 33

DIAGNOSIS: Zoarium encrusting. Zooecial frontal gently convex, bordered by areolae and ending at edges in a thin salient rim. Secondary orifice a low peristome with wedge-shaped median frontal

sinus below which, in a loop of the pleurocyst, is a large, external, pear-shaped frontal avicularium. The avicularium is mounted on a mound of varying prominence and outlined by a line leading to the peristomial notch. A few frontal pores, spaced far apart, encircle the avicularial mound. Primary orifice with low wide lyrula and two large, blunt cardelles. Ovicells globose, with a few pores outlining the frontal area. Mandibular area large and oval.

This species is named for the decorative effect of its frontal avicularium, from the Latin "ornatus" (decorated, adorned) and "*pectoris*" (chest).

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 1.427–2.001 (1.696)
Z–W, 0.522–0.999 (0.745)
Av–L, 0.331–0.461 (0.400)
Av–W, 0.202–0.274 (0.232)
B–L, 0.259–0.317 (0.294)
Pr–Or–L, 0.230 (Two readings)
Pr–Or–W, 0.259 (Two readings)
Se–Or–L, 0.187–0.259 (0.222, excluding sinus)
Se–Or–W, 0.259–0.317 (0.280)
Se–Or–Si–D, 0.072–0.115 (0.092)
Se–Or–Si–W, 0.058–0.101 (0.073 mm.)
Ly–L, 0.029–0.043 (0.031)
Ly–W, 0.079–0.101 (0.090)
Ov–L, 0.547–0.562 (Three intact ovicells)
Ov–W, 0.504–0.547 (Three intact ovicells)

Zoarium: The zoarium is encrusting and of ivory color. It is brittle and fragments easily.

Zooecia: A salient rim outlines zooecial boundaries. Zooecia are very large, considerably longer than wide, and 4–6-sided. Two kinds are present, those with ovicells and those without. The latter are in the majority. The frontal wall is gently convex except in a few zooecia where the avicularial mound develops into an excessive bulge (pl. 33,F). The frontal is a pleurocyst, with areolae, short interareolar ribs, a pebbled surface, and a few small widely spaced pores around the avicularial mound. The areolar pores are large and close together. Some zooecia have a smooth rather than a pebbled surface. The lateral walls are thinner. A line of rounded pores (sometimes as many as 10) of fairly uniform size and equal spacing can be seen in the lateral walls.

Avicularium: A single avicularium is present on each zooecium, with position and orientation identical in all cases. The avicularium is cradled on a mound in the midline just proximal to the peristomial notch. The pleurocyst forms a loop around it and continues distally on each side beyond it to form the peristome (pl. 33,A). The avicularium is large and pear shaped. Its small, subcircular distal part is called the "back area." Its shallow, wide, oval, large, proximal part is the "beak, rostrum or mandibular area." A short pivot bar separates the two across the top. The avicularium is longitudinally placed and occupies a considerable part of the frontal surface. It lies

parallel to the frontal zooecial plane. Its rostral floor is crescentic (pl. 33,E). No soft or chitinous parts (mandibles and opercula) are present in the zoids.

Orifice: The orifice is nearly terminal, at the zoid edge. A short peristome forms a partial collar frontally and laterally. It is a bit taller in front than at the sides. Medially it is notched. The low medium-wide lyrula of the primary orifice is just back of (internal to) the peristomial notch. The cardelles are sturdy and placed on the side walls. The primary orifice is well shielded by the peristome.

Ovicells: The globose salient ovicell partly overhangs the orifice. It is slightly roughened peripherally and thinner and flatter centrally. A few pores border the frontal area. Occasional smaller ones may be distributed haphazardly over the thin frontal. The oral border of the ovicell is faintly curved.

Distribution: The holotype (USNM 11307) is from Station 45 and the paratype is from Station 44. The holotype fragment originally measured 8 by 9.5 mm. but subsequently fragmented. The paratype consists of a few loose zoids and a few growing on another bryozoan encrustation.

Affinities: *Smittoidea ornatipectoralis* seems to be related to the fossil *Porella concinna* which MacGillivray reported and figured (1895, pl. 12, fig. 6) from Australia, but differs from the illustrated specimen in two ways. The avicularium in MacGillivray's species is placed much higher in the peristome, widely interrupting the peristomial collar; and in his species the areolae are few in number and far apart. He mentions (p. 91) that one of his Muddy Creek specimens had very large median avicularia and that the mandible was very large, much expanded inferiorly, and extended half way down the zooecium.

Andersson (1902, pl. 30, fig. 5, pp. 546–547) describes a *Smittia palmata* var. *sinuosa* which has a very large frontal avicularium but which differs in shape from the Antarctic species. His variety further differs from *S. ornatipectoralis* in the shape of the secondary orifice, which is almost lemon shaped, and in the greater extent of the ovicell porous plate.

Smittoidea ornatipectoralis brevior, new subspecies

Plate 34

Diagnosis: Zoarium encrusting. Zooecial frontal gently convex, bordered by areolae and ending at edges in a thin salient rim. Secondary orifice a low peristome with a wide frontal sinus or interruption. Primary orifice with a low, medium-wide lyrula and two laterally originating heavy blunt cardelles. A small to medium-sized broadly

oval suboral avicularium is mounted on a mound of varying prominence and outlined by a line leading to the peristomial notch. A few (about 6) small, widely spaced pores encircle the aviculiferous mound. Ovicells globose, but damaged (or frontals missing), so data on them is incomplete.

This subspecies is named for its similarity to the species and its smaller avicularia, from the Latin "brevis" (short).

MEASUREMENTS: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271).

Z–L, 0.922–1.340 (1.068)
Z–W, 0.348–0.766 (0.593)
Av–L, 0.122–0.288 (0.212)
Av–W, 0.094–0.202 (0.140)
Pr–Or–L, 0.173–0.202 (0.188)
Pr–Or–W, 0.209–0.230 (0.220)
Se–Or–L, 0.158–0.216 (0.186, excluding notch)
Se–Or–W, 0.202–0.274 (0.225)
Se–Or–L, 0.216–0.259 (0.228, including notch)
PN–L, 0.036–0.072 (0.053)
PN–W, 0.043–0.072 (0.053)
Ly–L, 0.029–0.043 (0.035)
Ly–W, 0.072–0.101 (0.086)
Ov–L, 0.533–0.562 (0.518, only 3)
Ov–W, 0.475–0.518 (0.499, only 3)
M–L, 0.079–0.202 (0.138)
M–W, 0.079–0.173 (0.120)

ZOARIUM: Encrusting and of ivory color. The holotype, which has polypide remains within, is rather fragile and fragments easily. It originally measured 9 by 9 mm. Another colony which is overgrown by other calcareous Bryozoa is more sturdy.

ZOOECIA: A salient rim outlines the zooecial boundaries. Although zooecia are large, they are smaller than those of *S. ornatipectoralis*. The zooecia are 4–6-sided and longer than wide. Two kinds are present—those with and those without ovicells, but they do not differ otherwise. A few zooecia overgrow others to form a second layer. The zooecial frontal is a convex pleurocyst and pebbled in texture. Ribs separate the closely set areolae. The avicularial mound is raised above the zooecial frontal and is punctured by up to three pairs of small pores around its base.

AVICULARIUM: A single suboral avicularium is present on each zooecium with position and orientation identical in all cases. The avicularium is cradled in the midline, just proximal to the peristomial notch. It is flat against the chest, so to speak, or in a plane parallel with the frontal surface. The pleurocyst forms a loop around it and continues distally on each side beyond to form a peristome, but the open end of the loop is wider in this variety than in the typical species. The avicularia are very broadly oval and of medium size. They are smaller than those of the typical species. The back area is a low wide arc, and consequently the pivot bar is longer, relatively, than in the typical species. The mandibular part is broad and not very long. Moreover, the opening in the rostral floor is of a slightly different shape from that of the typical species. The chitin-rimmed

mandible is a truncated oval. It has a U or Y shaped reinforcement about the center.

Orifice: The primary and secondary orifices of this variety are similar in appearance to, but smaller than, those of the typical species. Moreover, the peristomial notch does not taper so much to a wedge but is more open than in the typical form.

The operculum is irregularly reinforced with chitin. A definite chitinous band, lke a thin wire, extends about three-fourths of the way around the operculum. At the sides are parenthesis-shaped sclerites which curve slightly inward from this band. A broad sheet of chitin begins to grow inward (i. e., across the operculum) from the peripheral band. It grows faster from the sides until the thickened strips meet in the opercular central area, in the oldest opercula (cf. pl. 34,C–E).

Ovicells: No complete ovicells, only beginning ones, are on the holotype. Three fully developed, globose, but broken ovicells are on a paratype from Station 44. The ovicell frontal surface is missing from these, however.

Distribution and ecology: The holotype (USNM 11318) is from Station 226, tbe paratype from Station 44. Some of the holotype zoids have polypide remains in them.

Affinities: This variety is very similar to the typical *S. ornatipectoralis*, differing only in its smaller, differently proportioned avicularia, the broader peristomial notch, smaller size of both orifices, and smaller zooecia, although the last is not an important character.

Smittoidea reticulata (?) (Johnston)

Plate 35

Lepralia reticulata. Johnston, 1847, p. 317, pl. 55, fig. 10.—Busk, 1854, pl. 90, fig. 1 (not pl. 93, figs. 2–4 or pl. 102, fig. 1).

Smittoidea prolifica? Osburn, 1952, pl. 48, figs. 7, 8 (considered by Bassler, 1953, p. G209, to be a synonym for *S. reticulata*).

The above is a partial synonymy only.

Remarks: The identification of the Antarctic specimens of this form is very uncertain for two reasons. First, there is not enough whole material, ovicells, or completed peristome to make identification absolutely certain. Second, *Smittoidea reticulata* is one of the most scrambled species in the family because its original hazy description by MacGillivray (1842, pp. 467–468) is not accompanied by a figure. Johnston (1847) at least figures it diagrammatically, without ovicells and with a hole for the avicularium. Busk (1854, pl. 90, fig. 1, pl. 93, figs. 2–4, pl. 102, fig. 1), in his handsomely illustrated catalog, had five figures, presumably of *L. reticulata*, but un-

fortunately none of these (except pl. 90, fig. 1, also without ovicells, unfortunately) seems to agree with Johnston's figure. Brown (1952, p. 330) is of the opinion that Busk's plate 102, figure 1 is possibly Brown's *Smittina acaroensis*, but Brown's *S. acaroensis* appears to be *Smittoidea evelinae* Marcus 1937 rather than Levinsen's *S. acaroensis*. Hincks (1880, pl. 48, figs. 1–5) beautifully figured *Smittia reticulata* but only his figure 2 approaches that of Johnston's figure 10 and Busk's plate 90, figure 1.

Canu and Bassler in their genuinely helpful and monumental 1920 monograph reproduced Hincks' plate 48, figures 1, 4, 5 as the *Smittina reticulata* MacGillivray.

Brown (1952, pp. 329–330) has valiantly attempted to unravel some of the tangled skein but the task has been difficult.

Osburn's *Smittoidea reticulata* (1952, pl. 48, figs. 9, 10) appears to differ somewhat from the species listed above. His *Smittoidea prolifica*, however, does come closer to Johnston's figure than does his *reticulata*.

Lastly, Bassler (1953, p. G209) considers *S. prolifica* Osburn a synonym of *Lepralia reticulata* Johnston, 1847.

Regardless of how great the confusion is, so long as each writer adequately illustrates his finds there is hope of eventually stabilizing the synonymy.

Diagnosis (of the present Antarctic specimen only): Frontal an areolated pleurocyst. Primary orifice small, as long as wide, smittinoid, with low medium-wide lyrula, lateral cardelles, and a small oval avicularium in front of the lyrula, within the peristome, i. e., in a widely open peristomial loop. Other avicularia, ovicell, and ultimate appearance of secondary orifice and peristome unknown because of paucity of material.

Measurements: Minimum to maximum and average measurements, in millimeters, are given below (for explanation see p. 271). The measurements are based on only two or three readings because of so little material.

Z–L, 0.792–0.994 (0.912)	Ly–L, 0.029
Z–W, 0.475–0.850 (0.655)	Ly–W, 0.072
Av–L, 0.115–0.122 (0.119)	Pr–Or–L, 0.158–0.187 (0.173)
Av–W, 0.079–0.101 (0.090)	Pr–Or–W, 0.173–0.187 (0.181)

Zooecia. Only pieces of 11 broken zooecia mounted on a slide after having been removed from a rock from Station 184 could be found. Of these pieces three frontals had orifices and two had incomplete avicularia. The zooecia are of considerable size. Their distal walls are curved, the lateral walls curved to angular. The frontal walls are areolated and roughened (a pleurocyst). The areolae are of varying shapes.

Avicularia: The only two avicularia present are damaged or incomplete; they are shown in plate 35,B,D. They are oral, oval, median, and tipped forward a bit, within the peristomie. The avicularial chamber is symmetrical, small, and median.

Orifice: The primary orifice curves deeply distally, is flatter laterally, has a shallower proximal curve, and a low, medium-sized lyrula. At the sides are two blunt, thin cardelles. The secondary orifice is not complete in the available specimens. However, what there is of it appears to be elevated at the sides and proximal corners and at the sides and beak tip of the avicularium, confining the avicularium to the peristomie and separating it from the rest of the frontal surface. The length of the incomplete secondary orifice is 0.317–0.331 mm.

Ovicells: Not seen.

Distribution: The Antarctic specimen is from a rock from Station 184, Marguerite Bay

Waters (1904, p. 62) reported a *Smittia reticulata* "with avicularia slightly longer than is usual in the European form," from the Antarctic, but since it is not figured it is uncertain as to what species he had. It cannot be the present form, however, because of his notation of the avicularia.

Thornely (1924, p. 14) also reported but did not figure a *Smittia reticulata* with wide spatulate avicularia and squarish orifice, from the Antarctic. Here again, the identity of the species is open to serious question. It probably is not the same as that of Waters and definitely is not the present form.

Since the present material is so fragmentary it, too, is of questionable determination, but the specimens do seem to agree rather closely with Dr. Osburn's *S. prolifica*, which Dr. Bassler has declared to be synonymous with *S. reticulata*. Therefore the specimens are being so identified. Osburn's specimens are from various California and eastern Pacific localities.

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U. S. GOVERNMENT PRINTING OFFICE: 1956

Plates 1—35

Plate 1

Barentsia discreta Busk

(All figures drawn with aid of camera lucida)

Figure A: One zoid, drawn from the right side. Rigid peduncle shows a faint annulation or incipient joint (J), lacking in peduncles of other zoids in the collection sample. Scale *a*.

Figure B: Basal part and flexible musclia of two zoids. Left musclium rests on base off our stolons; right one shows two stolons. Scale *a*.

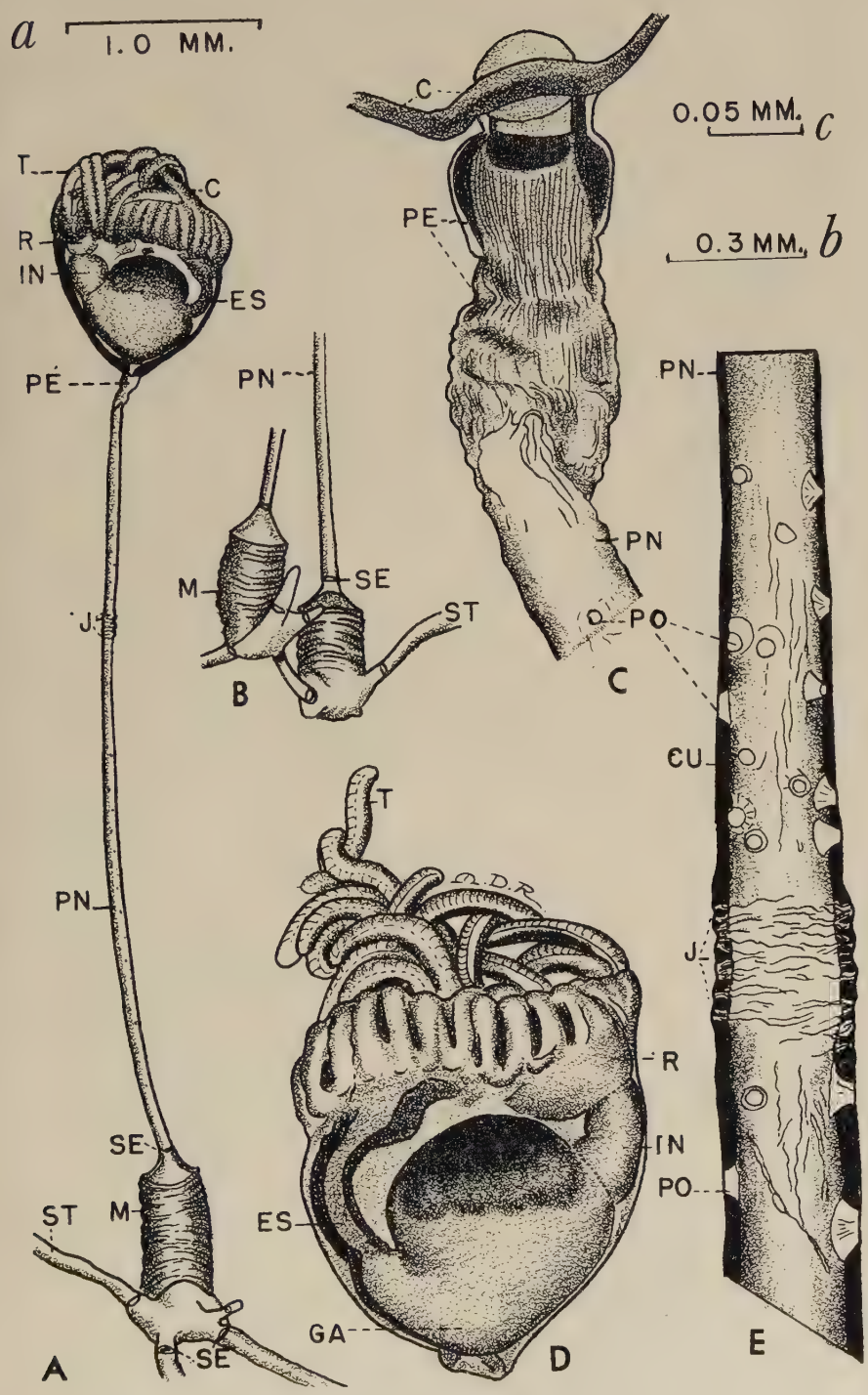
Figure C: Soft, flexible, muscular pedicel; top of rigid peduncle; and base of fleshy calyx. Scale *c*.

Figure D: Calyx as seen from left side. Structures topping the stomach were difficult to distinguish and are not pictured very well here. Darkest area is location of liver and gonads and is the ambiguous area referred to. Lophophore contracted and curved over so tentacles are tangled in vestibule. Scale *b*.

Figure E: Enlargement of annulated peduncle region of figure A. Thick inner chitinous cuticle layer is interrupted by the irregularly spaced "pores" (PO) which characterize peduncle of *Barentsia discreta*. Outer chitinous layer very thin and barely indicated by light colored wrinkling in annular region (J). Scale *c*.

Key to abbreviations

C, calyx
CU, inner chitinous cuticle layer
ES, esophagus
GA, stomach
IN, intestine
J, incipient joint or annulation
M, musclium
PE, pedicel part of stalk
PN, peduncle part of stalk
PO, pore or gap in inner cuticle layer
R, rectum
SE, septum
ST, stolon
T, tentacles



EXPLANATION ON OPPOSITE PAGE

PLATE 2

Map of world showing wide distribution of *Barentsia discreta*. Numbers 1 through 34 indicate collection locations. Localities and reporting author are cited in the following list. Abbreviations: "m." for meters and "fath." for fathoms.

1. Roberston (1900), San Pedro, Calif.
2. Waters (1904), Magellanes, Chili.
3. Jullien (1888), Ile Hoste, Cape Horn, 26 fath.
4. Present report (Rogick), Stations 190, 234, 243, in Marguerite Bay, Antarctica, lat. 68°30′ S., long. 68°30′ W.; 35–40 fath. Collectors David C. Nutt and Mr. Layton.
5. Marcus (1937), Bay of Santos, Brazil, 20 m.
6. Osburn (1947), 2 miles southwest of Cape da Vela, Caribbean Sea, 21–22 fath.
7. Osburn (1940), Guanica Harbor, Puerto Rico, 5–10 fath.
8. Osburn (1912; 1914), Tortugas, Fla., 18 fath.
9. Osburn (1940), Verrill (1900), Bermuda.
10. Osburn (1912), Beaufort, N. C.
11. Osburn (1932; 1944), near mouth of Chesapeake Bay, 47.75 m.
12. Hutchins (1945), Long Island Sound, Conn.
13. Osburn (1912; 1932), Woods Hole, Vineyard Sound, and Buzzards Bay, Mass.
14. Waters (1918), Cape Verde Islands, 10 fath.
15. Busk (1886), Tristan da Cunha, 100–150 fath.
16. Ehlers (1890), Cartagena, Spain.
17. Zirpolo (1927), Gulf of Naples, Italy.
18. Thornely (1905), Ceylon.
19. Annandale (1912), Port Canning, India.
20. Toriumi (1949), Pacific Coast of Miyagi Prefecture; Mawatari (1948) and Toriumi (1951) from Matsushima Bay. All in Northern Honshu, Japan.
21. Oka (1895), south of Tokyo, Japan, 40–53 fath.
22. Mawatari (1952), Kii Peninsula, Japan.
23. Kirkpatrick (1890), Tizard Bank, South China Sea, 27 fath.
24. Harmer (1915), off western tip of Dutch New Guinea, 32 m.
25. Harmer (1915), southwest of Dutch New Guinea, 57 m.
26. Harmer (1915), Makassar, Celebes, 0–36 m.
27. Harmer (1915), Saleyer, Celebes, 0–36 m.
28. Thornely (1924), Commonwealth Bay, off Adelie Land, Antarctica, 25–30 and 55 fath.; Johnston and Angel (1940), Commonwealth Bay off King George V Land, Antarctica, 15–25 fath.
29. Marcus (1921; 1939), Campbell Island.
30. Kluge (1946a), Gorbunov (1946), Arctic Ocean.
31. Johnston and Angel (1940), Royal Sound, Kerguelen Island, 91 m.
32. Johnston and Angel (1940), off Enderby Land, 300 m.
33. O'Donoghue (1924), off Illovo River, Natal, east coast, 27 fath.
34. O'Donoghue (1924), Cape Infanta, 30–40 fath.

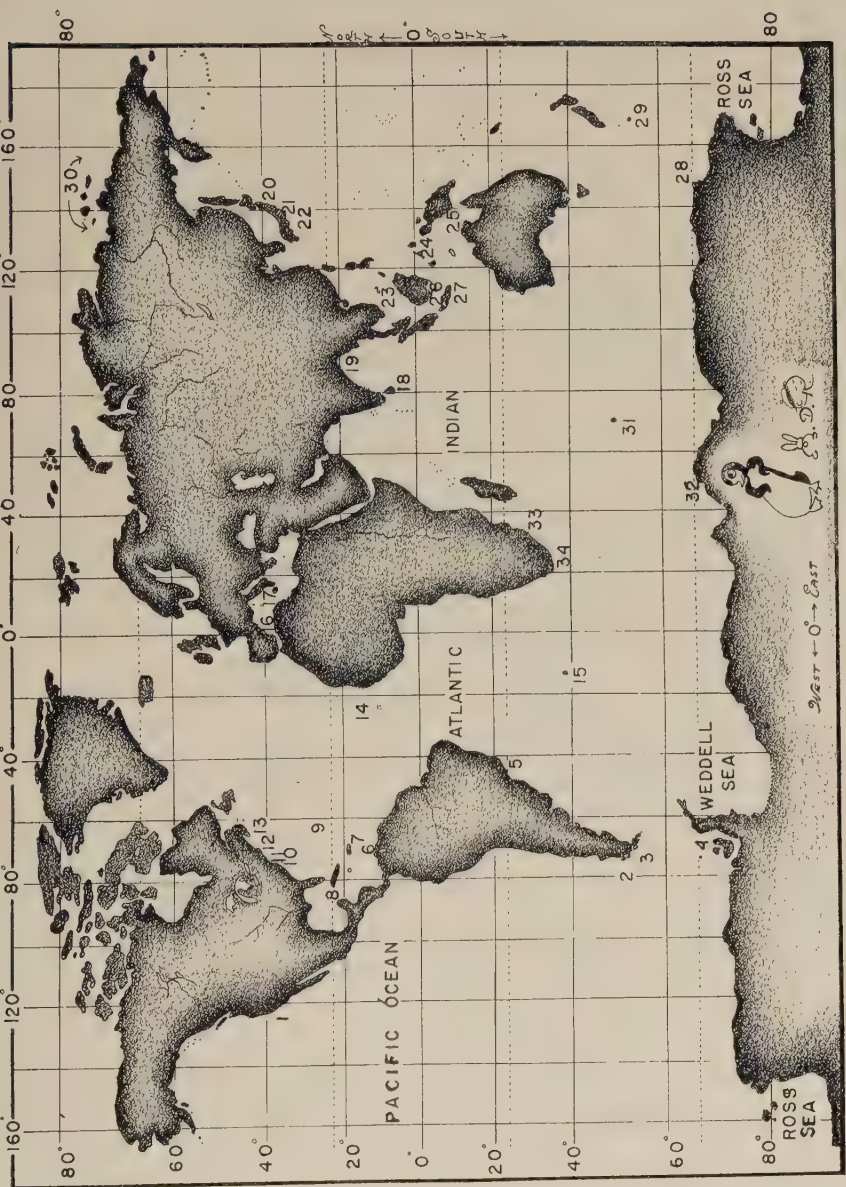


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PLATE 3

Map of Antarctic Continent showing location of the numbered collecting stations from which Bryozoa were taken by the U. S. Navy's 1947–48 Antarctic Expedition. Boxed letter A, directed at Peter I Island, shows location of collecting stations 148, 149, 161, 162 and 163. Boxed letter B, directed at Marguerite Bay, shows location of collecting stations 179, 180, 181, 184, 189, 190, 193, 194, 225, 226, 229, 230, 233, 234, 236, 238, 240 and 243.

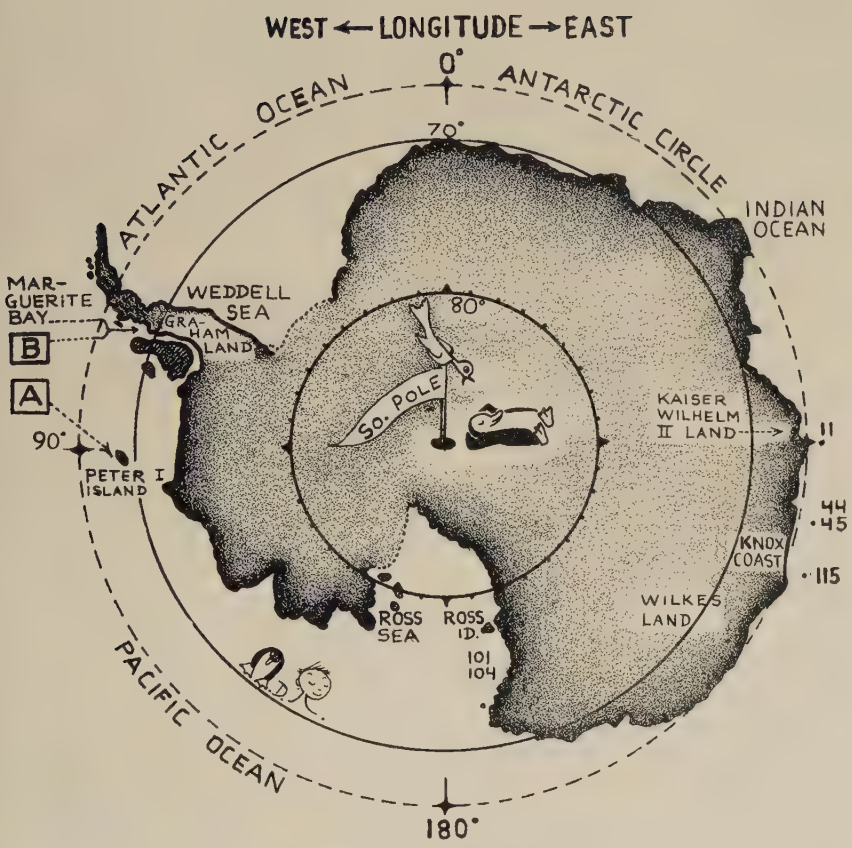

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Plate 4

Cellaria vitrimuralis, new species

(All figures except D and F drawn with aid of camera lucida)

Figure A: Avicularium, with mandible (M) in place. Seen from slight side-angle that shows protrusion and prominence of rostrum (R) into which mandible fits, and ledges (L) against which the mandible base articulates. Bladelike wall of avicularium evident at bottom left and top. Drawn to scale *a*.

Figure B: Avicularium seen from front. Note muscles (U) and sclerites (S) or reinforcements of mandible, its distal position and relatively large size. Drawn to scale *a*.

Figure C: Orifice (O), showing the two proximal denticles (Y) and overhanging distal wall or "cornice" (K). At each side of orifice are the two parentheses lines (P) and external to them are the cryptocyst ridges. Drawn to scale *a*.

Figure D: Free-hand habit sketch. Colony jointed and branching dichotomous.

Figure E: View of another avicularium, showing more extensive reinforcement of mandible and two lines representing cryptocyst ridges. Drawn to scale *a*.

Figure F: Cross section of a branch, showing pentamerous arrangement of zoids. Cut was made through two series of zoids, i. e., where two series overlap. Free-hand sketch.

Figure G: Avicularian mandible, from inner side, showing hooked or pointed terminal end and three sclerites at basal end. Drawn to scale *a*.

Figure H: Colony fragment. Full view of five autozoids and one avicularium. Avicularium replaces a regular autozooecium in the transverse series. Transparent side walls show through frontal walls and thus account for the number of longitudinal lines in the figure. None of the zooecia here pictured has an ovicell. A few opercula are in place (PR). Drawn to scale *b*.

Figure I: Colony fragment, showing zone of dichotomous branching and single large tubular radicle "fiber" or tube which arises from frontal surface of a zooecium. The zooecia in this fragment do not have ovicells. Drawn to scale *c*.

Figure J: Colony fragment from an ovicelled branch. The large globular endotoichal ovicells (OV) show through the transparent zooecial walls. Ovicell opening (OP) is directly above zooecial orifice. Drawn to scale *d*.

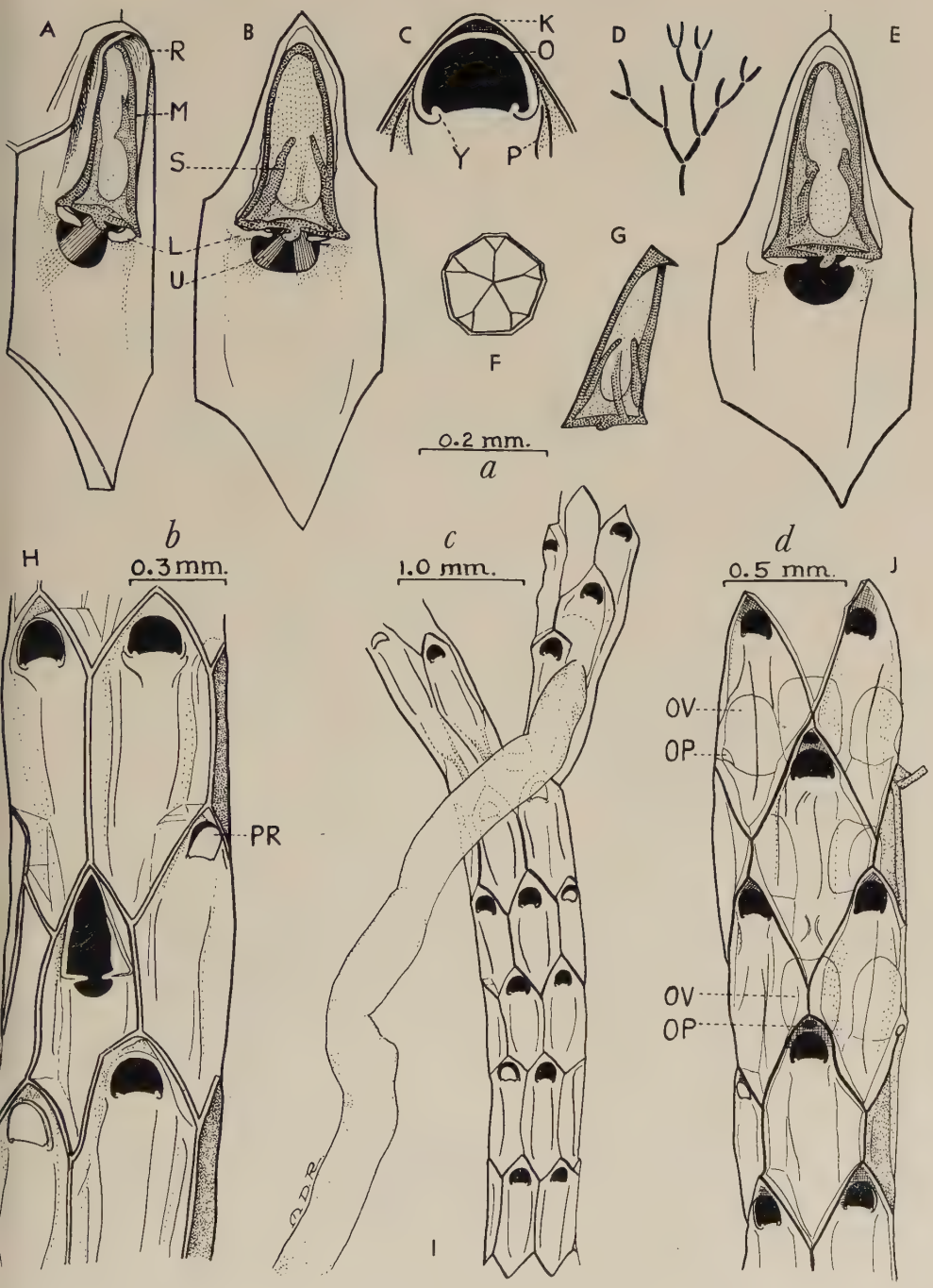

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Plate 5

Cellaria vitrimuralis, new species, and *C. moniliorata*, new species

(All figures except figure F drawn with aid of camera lucida)

Figure A: *Cellaria vitrimuralis*, new species. Enlargement of portion of ovicelled colony, showing length of proximal parts (PZ) of some zooecia and distal parts of others, salient thin glasslike walls (W), frontal transparency, and relation of the ovicells (OV) to the zooecia. Hexagonal areolation is plain and superficial. Inner walls (L) of zoids do not parallel the outer hexagonal pattern (W). Scale *a*.

Figure B: *C. vitrimuralis*. A slightly tipped frontal, top, and one side view of an operculum and its attached musculature, flattened plates and flange or rim. Scale *b*.

Figure C: *C. vitrimuralis*. Frontal view of operculum, with one of muscle plates showing, the other having been broken off in dissection. Scale *b*.

Figure D: *C. vitrimuralis*. Operculum from the right side, showing the muscle plate (MP) and the flange (F). Scale *b*.

Figure E: *C. vitrimuralis*. View of nonovicelled fragment of colony and of joint or node area. The deep yellow or amber color of inner walls at joints shows through transparent outer wall. No tangle of rootlets present at intersection of branches of this species. Scale *c*.

Figure F: *Cellaria moniliorata*, new species. Free-hand sketch of growth habit.

Figure G: *C. moniliorata*. Stereogram of broken end of branch. Zooecia grouped in transverse linear rows of four. At this level the four larger zooecial cavities belong to the zooecia of one series while the four smaller cavities belong to zooecia of a second series.

Figure H: *C. moniliorata*. Operculum in place in orifice. Parenthesis-shaped sclerites on each side of the orifice. Rim of orifice indicated.

Figure I: *C. moniliorata*. Node of colony showing tangle of yellow radicle fibers at junction of the three internodes. Zooecial surface pebbled or covered over with small beadlike bumps. Beaded cryptocyst ridges show best in right-hand branch and in basal zoid. Scale *d*.

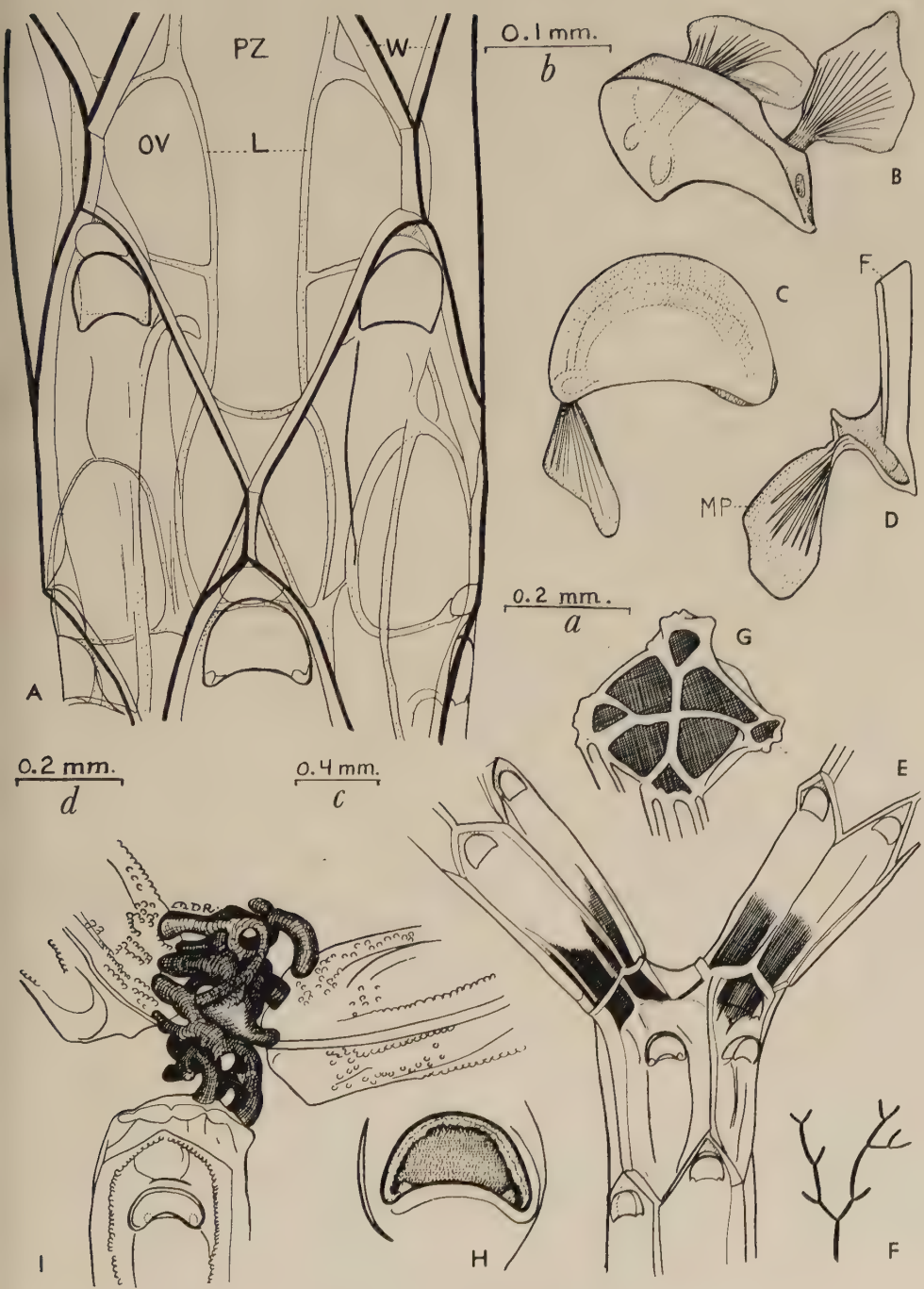

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Plate 6

Cellaria moniliorata, new species

(Figures drawn with aid of camera lucida)

Figure A: Part of fertile branch showing every zooecium topped by endotoichal ovicell. Ovicells give branch a swollen look. Frontal walls of neighboring distal zooecia meet in salient suture over each ovicell. Zooecia are in series of four around the branch. Scale *a*.

Figure B: Enlargement of part of the branch in figure A showing beaded cryptocyst ridges (cr), orifices, ovicell openings, and three ovicells (ov). Mural rim (mr) smooth, thin, and slightly raised. Scale *b*.

Figure C: Part of nonfertile branch showing autozoids in series of four and in hexagonal areolation. Two lower zooecia have opercula (op) in place in orifice. Scale *a*.

Figure D: Part of nonfertile branch showing three autozooecia and one avicularium inserted between them. Scale *b*.

Figure E: Avicularium with beaded frontal, raised beak narrowed and slightly curved. Scale *b*.

Figure F: Avicularium of figure D enlarged. Scale *d*.

Figure G: Branches, meeting at a node with its tangle of radicle fibers. Basal branch narrows a bit in this specimen. Scale *c*.

Figure H: Node with its tangle of chitinous radicle fibers. Tip of basal branch in this colony widened a bit at joint. Scale *e*.

Figure I: Branching, tangled, double radicles growing from front of an autozoid. Scale *a*.

Figure J: Zoid with single radicle growing from its front. Volcano-shaped raised front is calcareous; tube itself is chitinous. Scale *b*.

Figure K: Mandible of an avicularium. Scale *d*.

Figure L: Zooecial orifice showing beaded upper lip and smooth pouting lower lip. Scale *d*.

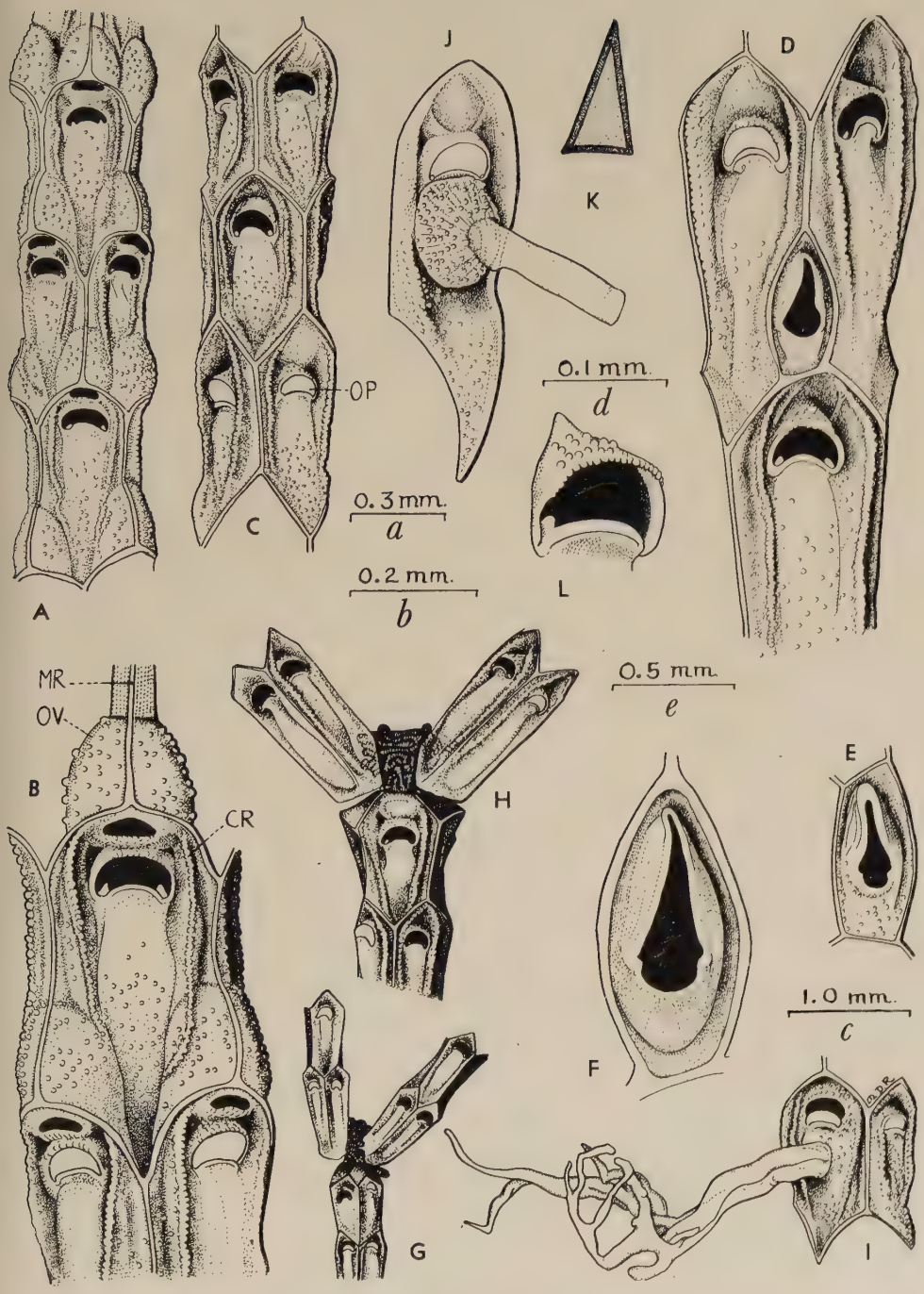

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Plate 7

Cellaria wandeli Calvet, *Cellariaeforma parvimuralis*, new species, and *C. extentamuralis*, new species

(Figures drawn with aid of camera lucida)

Figure A: *Cellaria wandeli*. Fragment of branch showing the strong areolation and several avicularia proximal to the zooecia. Ovicells above orifice and none of ovicell openings are perfect as the colony appears to be an old one. Scale *a*.

Figure B: *Cellaria wandeli*. Fragment of branch showing (from top to bottom) proximal part of a zooecium, an avicularium, an ovicell, and the elongate horseshoe-shaped zooecial orifice. Scale *b*.

Figure C: *Cellariaeforma parvimuralis*, new species. Avicularium. Scale *b*.

Figure D: *Cellariaeforma parvimuralis*. Cross section of a branch showing 10 zoid cavities. Scale *c*.

Figure E: *Cellariaeforma parvimuralis*. Single zooecium, showing detail of frontal and orifice. Scale *b*.

Figure F: *Cellariaeforma parvimuralis*. One of basal zooecia from which arise three radicle fibers. Frontal of zooecium was obscured by debris and orifice could not be plainly seen. Scale *a*.

Figure G: *Cellariaeforma parvimuralis*. Operculum from specimen, not dissected out. Scale *b*.

Figure H: *Cellariaeforma parvimuralis*. Branch fragment, showing single avicularium in relation to zooecia. Scale *c*.

Figure I: *Cellariaeforma extentamuralis*, new species. Ovicelled zooecium and avicularium. Scale *b*.

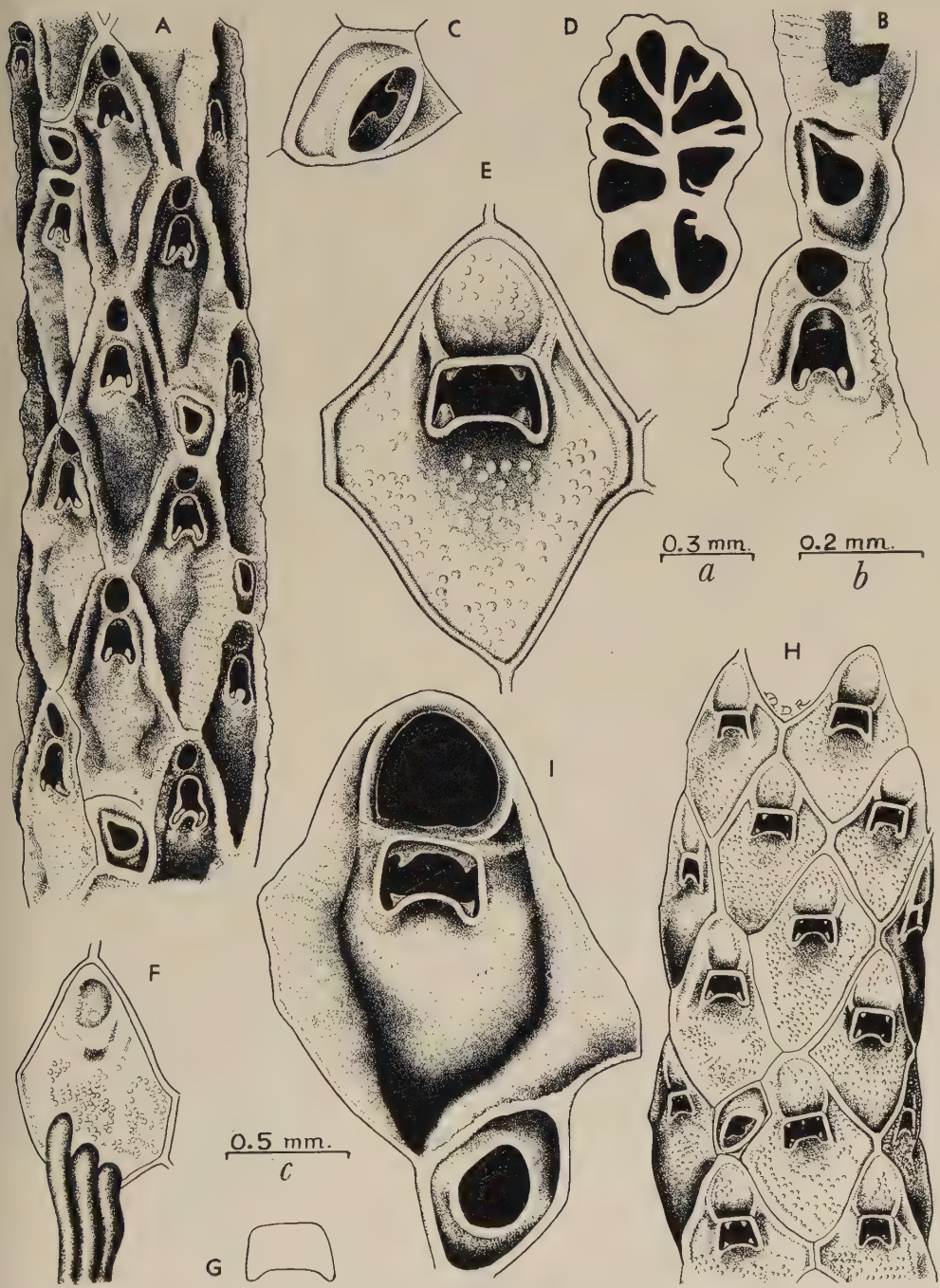

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Plate 8

Cellariaeforma extentamuralis, new species; *C. coronata*, new species; and *Mawsonia extensalata*, new species

(Figures drawn with aid of camera lucida)

Figure A: *Cellariaeforma extentamuralis*, new species. Low power view of branch having zooecia with ovicells and avicularia. Scale *a*.

Figure B: *Cellariaeforma extentamuralis*. Several ovicelled zooecia surrounding an avicularium. Scale *b*.

Figure C: *Cellariaeforma coronata*, new species. Four zooecia. Upper and lower zooecia show complete horseshoe-shaped cryptocyst ridge on calcareous frontal surface. Two lateral zooecia covered by parchmentlike membrane having parentheses-shaped lines about the orifice. Membrane is shown peeling off in places; the calcareous cryptocyst is beneath it. Scale *c*.

Figure D: *Mawsonia extensalata*, new species. A branch showing prominent flaps or cryptocyst extensions that give it a rough file-like appearance, and three large triangular-beaked avicularia. Scale *a*.

Figure E: *Mawsonia extensalata*. Several fertile zooecia and an avicularium. Ovicells are widely open considerable distance above zooecial aperture. Cryptocyst flaps meet directly over ovicells. Scale *b*.

Figure F: *Mawsonia extensalata*. An avicularium. Triangular beak has a slightly curved tip. Scale *d*.

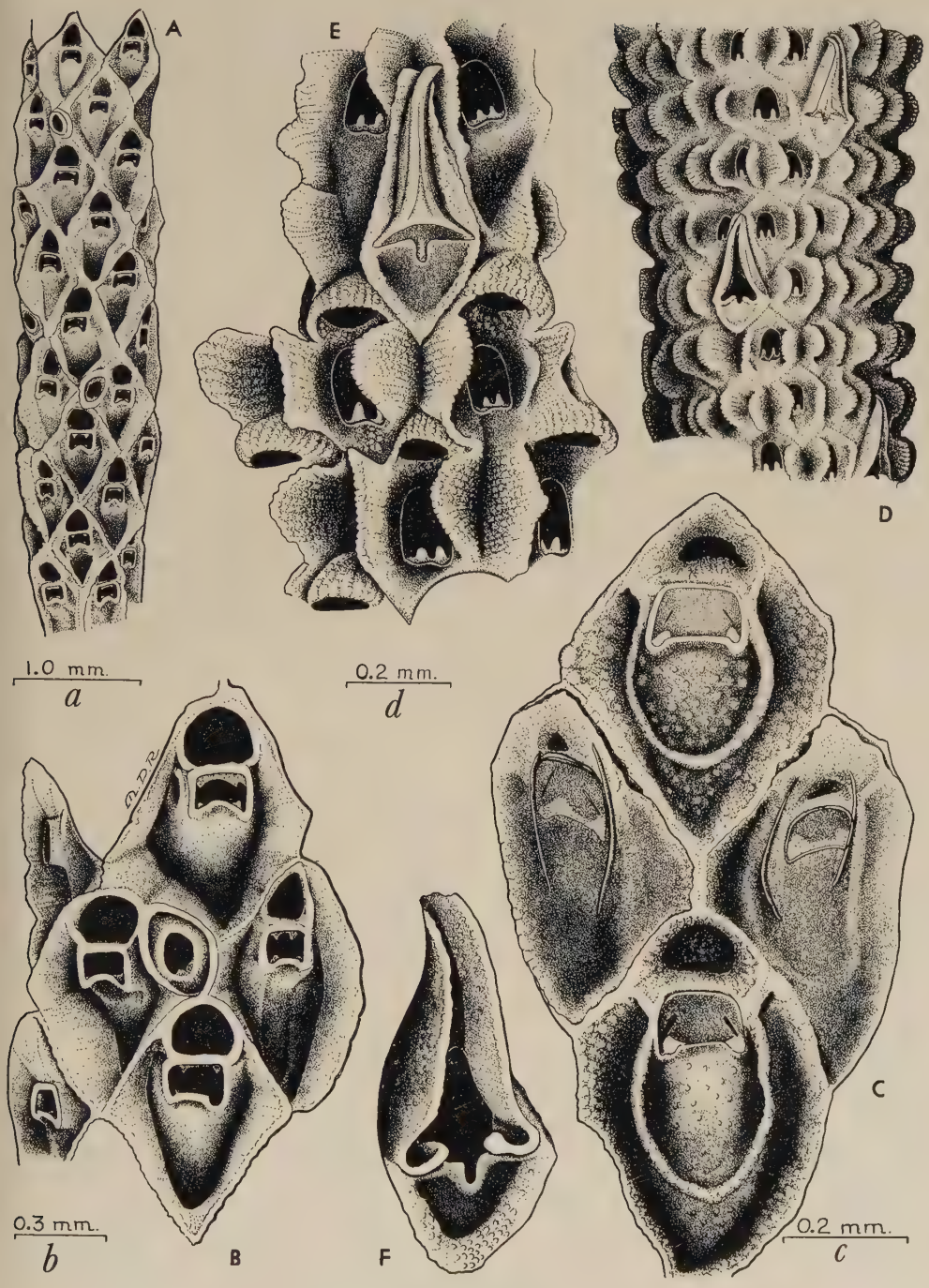

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Plate 9

Mawsonia extensalata, new species, and *M. membranacea* Thornely

(Figures drawn with aid of camera lucida)

Figure A: *Mawsonia extensalata*, new species. View of outer surface of avicularian mandible showing sharp knife-edge keel and curved tip. Scale *a*.

Figure B: *Mawsonia extensalata*. A fairly young zooecium. Depressed area between orifice rim and distal zooecial wall fills in and becomes heavily calcified in older zooecia, merging with the curved cryptocyst ridges. Scale *a*.

Figure C: *Mawsonia extensalata*. Avicularian mandible. Scale *a*.

Figure D: *Mawsonia extensalata*. Operculum tilted slightly to show reinforcements. Scale *b*.

Figure E: *Mawsonia extensalata*. Operculum seen from inner surface. Flange around inner rim is especially extended at the two sides into areas for muscle attachment. Scale *b*.

Figure F: *Mawsonia membranacea*. Side view of avicularian mandible showing the curved tip. Scale *c*.

Figure G: *Mawsonia membranacea*. Zooecium. Operculum is in the orifice, and has two light-colored or thinner oval areas for articulation with orificial condyles. Prominent smooth parentheses lines immediately enclose the orifice on two sides; around them curve the prominent, roughened, calcified, cryptocyst ridges. Scale *a*.

Figure H: *Mawsonia membranacea*. An older zooecium. Not many zooecia in the colony have such sharply raised mural rims. The two orificial condyles show plainly because operculum is missing. Scale *a*.

Figure I: *Mawsonia membranacea*. Outside view of avicularian mandible. Scale *a*.

Figure J: *Mawsonia membranacea*. Avicularium and mandible. Scale *a*.

Figure K: *Mawsonia membranacea*. Typical avicularium showing an odd opesia or opening to interior. Scale *a*.

Figure L: *Mawsonia membranacea*. An avicularium. Scale *d*.

Figure M: *Mawsonia membranacea*. Upper two-thirds of the only colony fragment of the species showing arrangement of zooecia and avicularia. From one zooecium springs a thin-walled rootlet. An avicularium is directly above, to the left of the same zooecium. Scale *e*.

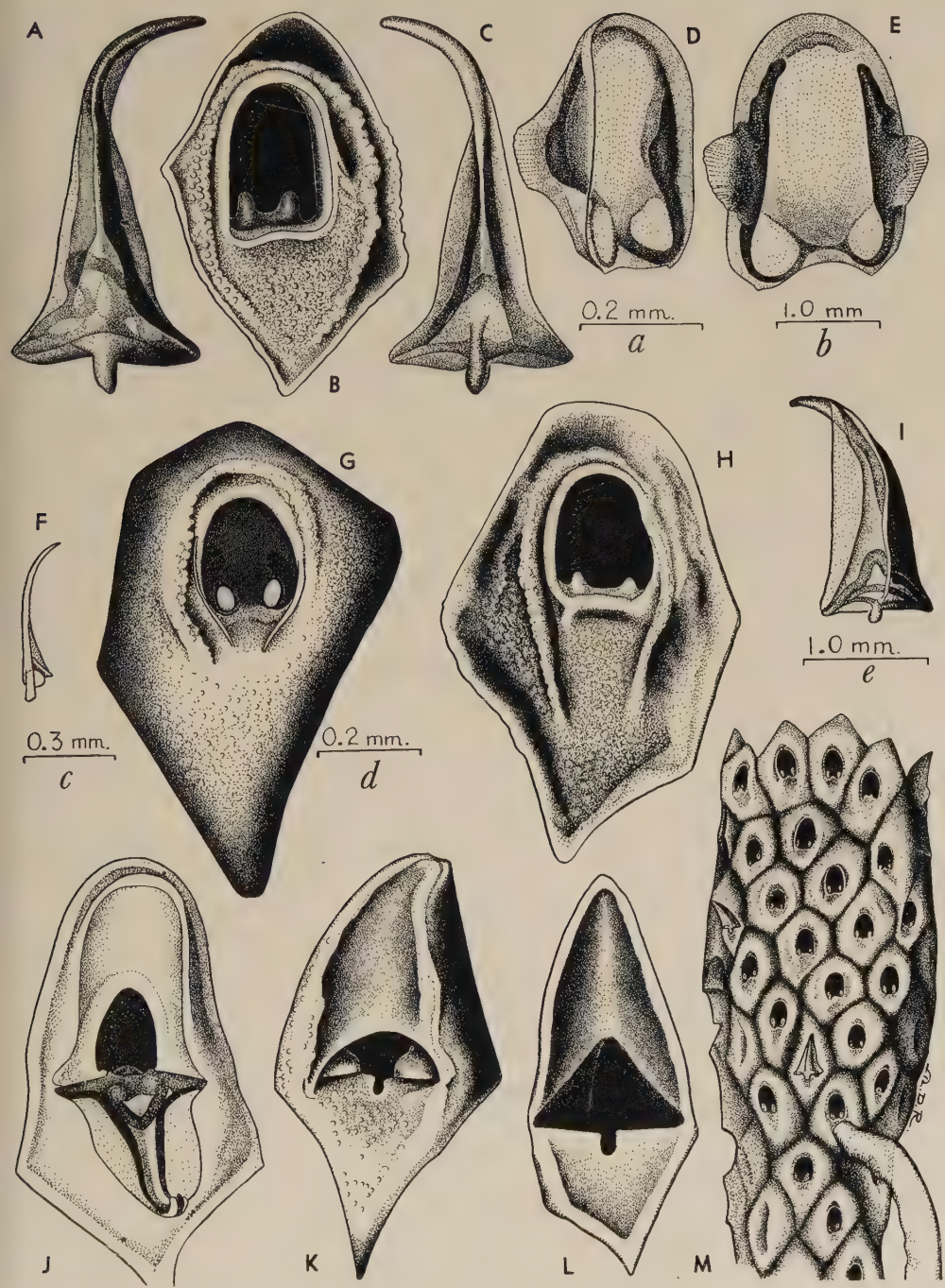

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Plate 10

Mawsonia membranacea Thornely and *Melicerita latilaminata*, new species

(All figures except B and C drawn with aid of camera lucida)

Figure A: *Mawsonia membranacea.* Six zooecia and an avicularium. Scale *a.*

Figure B: *Melicerita latilaminata.* Free-hand sketch of a colony, showing beginning of dichotomous branching and several rootlets sprouting from near base. Area between the two dotted lines is shown in figure D.

Figure C: *Melicerita latilaminata*, new species. Cross section diagram of a branch to show its flatness and bilaminate character.

Figure D: *Melicerita latilaminata.* Enlargement of approximate dotted area of colony shown in figure B. Zooecia are more or less hexagonal. Here and there are smaller pentagonal or hexagonal avicularia, four of which are pictured. Many zooecia have a small crescent-shaped ovicell opening above the larger but similarly shaped zooecial orifice. Scale *b.*

Figure E: *Melicerita latilaminata.* Inner porous end wall of a zooecium. These porous plates form distal-proximal walls of zooecia. Scale *c.*

Figure F: *Melicerita latilaminata.* One complete zooecium and parts of three others. Dotted lines show location and extent of body cavity of upper zooecium. External areolation or pattern formed by the frontal surface of the various zooecia overlies and obscures the true zooecial shape. Upper zooecium has an operculum in place over the orifice, while the two lateral zooecia show the pair of orificial condyles. Small crescent-shaped ovicell openings are at distal end of each zooecium. Parentheses lines appear around orifice of upper zooecium. Scale *d.*

Figure G: *Melicerita latilaminata.* Operculum, its surface faintly pebbled. Scale *e.*

Figure H: *Melicerita latilaminata.* An avicularium with mandible in place showing reinforcements of mandible; heaviest reinforcement is the encircling bar. Scale *c.*

Figure I: *Melicerita latilaminata.* An avicularium from which mandible has been removed to show shape of opening and the condyles, with which the mandible articulates. Scale *d.*

Figure J: *Melicerita latilaminata.* Basal region of colony with numerous rootlets sprouting from zooecial fronts. Rootlets are considerab'y longer than shown. Colony is narrowest here in basal region (compare with figure B). Scale *b.*

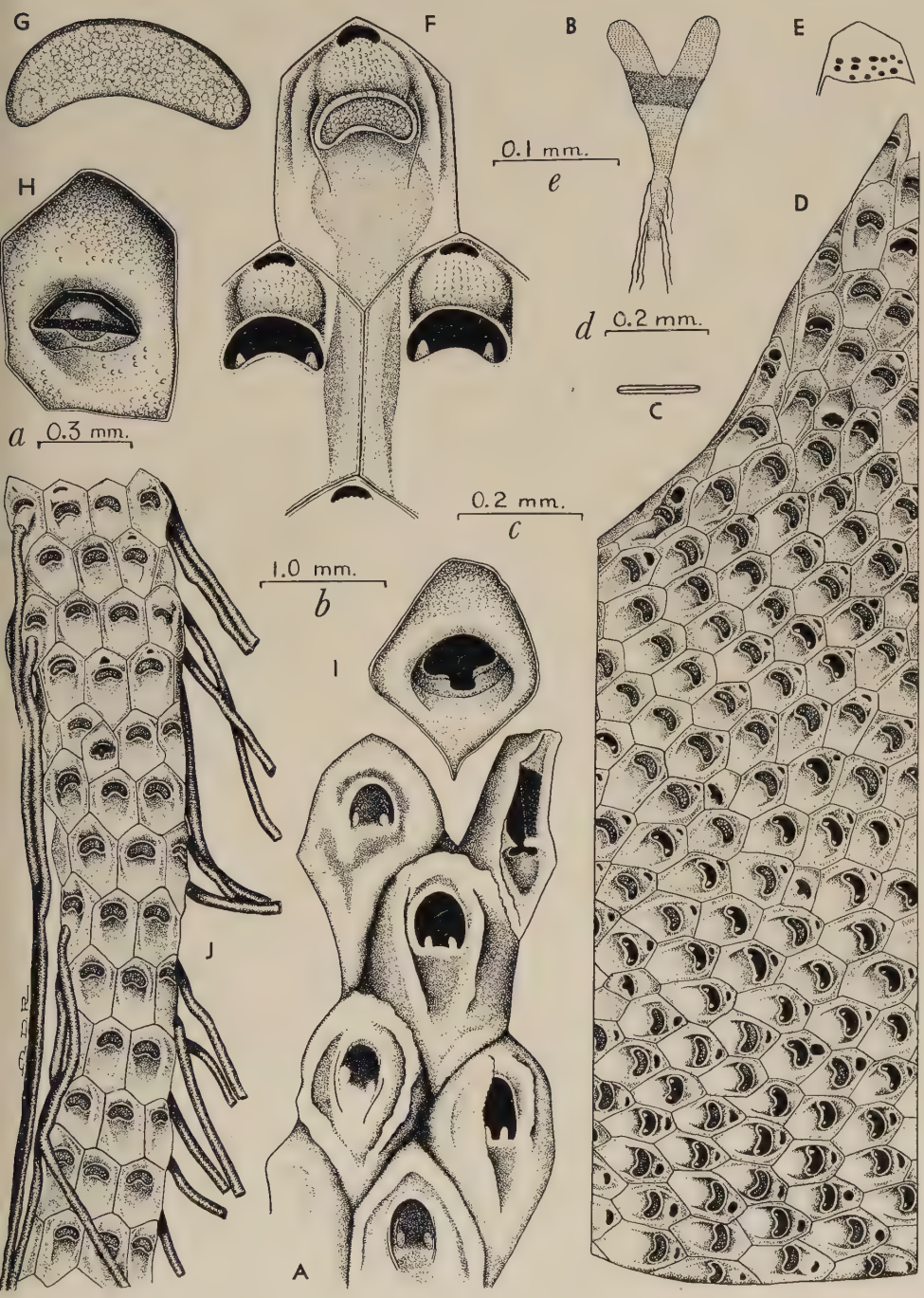

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Plate 11

Melicerita latilaminata, new species, and *M. obliqua* Thornely

(Figures drawn with aid of camera lucida)

Figure A: *Melicerita latilaminata*, new species. Zooecium from which has sprouted a chitinous rootlet (R). Scale *a*.

Figure B: *Melicerita latilaminata*. Parts of two zooecia, with an ovicell chamber (O) in front of one and above the other. Only the concealed proximal part of upper zooecium and the exposed distal frontal part (ZF) of lower zooecium are shown. Proximal zooecial cavity (ZC) is narrower than exposed frontal surface (ZF) and extends for considerable distance. Pores (P) are seen occasionally in the walls. Scale *a*.

Figure C: *Melicerita latilaminata*. Pore plate from distal-proximal wall between two successive zooecia. Scale *c*.

Figure D: *Melicerita latilaminata*. Two ovicelled zooecia and an avicularium. Zooecial orifice (OR) shows the two condyles. Ovicell opening (OP) has a slightly beaded lower border. Avicularian mandible (M) is in place. Scale *a*.

Figure E: *Melicerita latilaminata*. A heavily chitinized mandible. Scale *b*.

Figure F: *Melicerita latilaminata*. Another avicularian mandible. Scale *c*.

Figure G: *Melicerita obliqua*. One of two incomplete colonies. Two radicles are near the base. Four nodulations (N) occur along the stem. Scale *d*.

Figure H: *Melicerita obliqua*. Single zooecium showing key character of this species: an obliquely set orifice. Scale *e*.

Figure I: *Melicerita obliqua*. Zooecium, showing a thin-walled transversely grooved (striated or wrinkled) rootlet springing from frontal. Scale *e*.

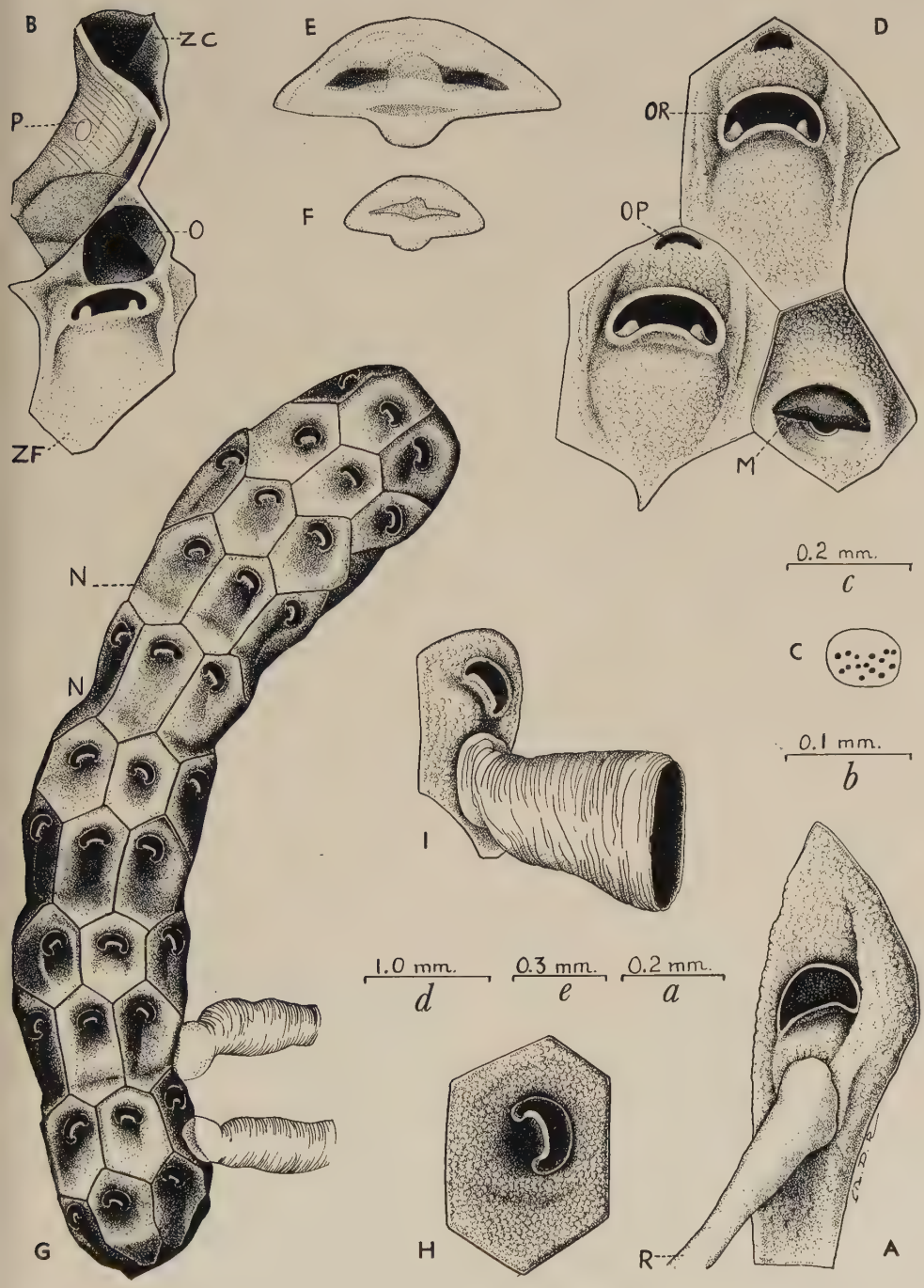

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Plate 12

Cellarinella margueritae, new species

(All figures except figure A were drawn with aid of camera lucida)

Figure A: A typical colony, 47 mm. long. Nodes are white, undotted; internodes are stippled. The dots represent orifices.

Figure B: Part of internode showing orifices of six zooecia. Three zooecia have external avicularia pointing to the left, three to the right. Two mucros, one with an avicularium, the other without, or "naked," are under each orifice, to the side. Scale *a*.

Figure C: A young, lightly calcified zoid tipped forward so interior of orifice can be seen better. Umbos not well developed yet. Diagonal oral ledge deep within the orifice shows, as does external suboral avicularium. Scale *b*.

Figure D: Looking down into primary orifice of a young zoid reveals relative position of back ledge, frontal oral ledge, internal avicularium, external avicularium, and mucros. Scale *b*.

Figure E: Internal avicularium with opened mandible and diagonal frontal oral ledge as seen from inside of zooecium. Compare with figure H for approximate position in a zooecium. Scale *c*.

Figure F: Two external avicularial mandibles with hooked tips and thinner oval area or lucida. Scale *c*.

Figure G: Orifice, mucros, and external avicularium. The two crossing dotted lines enclose the approximately 110° angle at which the avicularium is bent.

Figure H: Interior of a broken-away frontal wall shows several zooecial cavities and parts of two ovicelled zoids. The internal avicularia are obliquely directed. Two ovicells are exposed, also the very thick frontal wall, porous in places. Scale *a*.

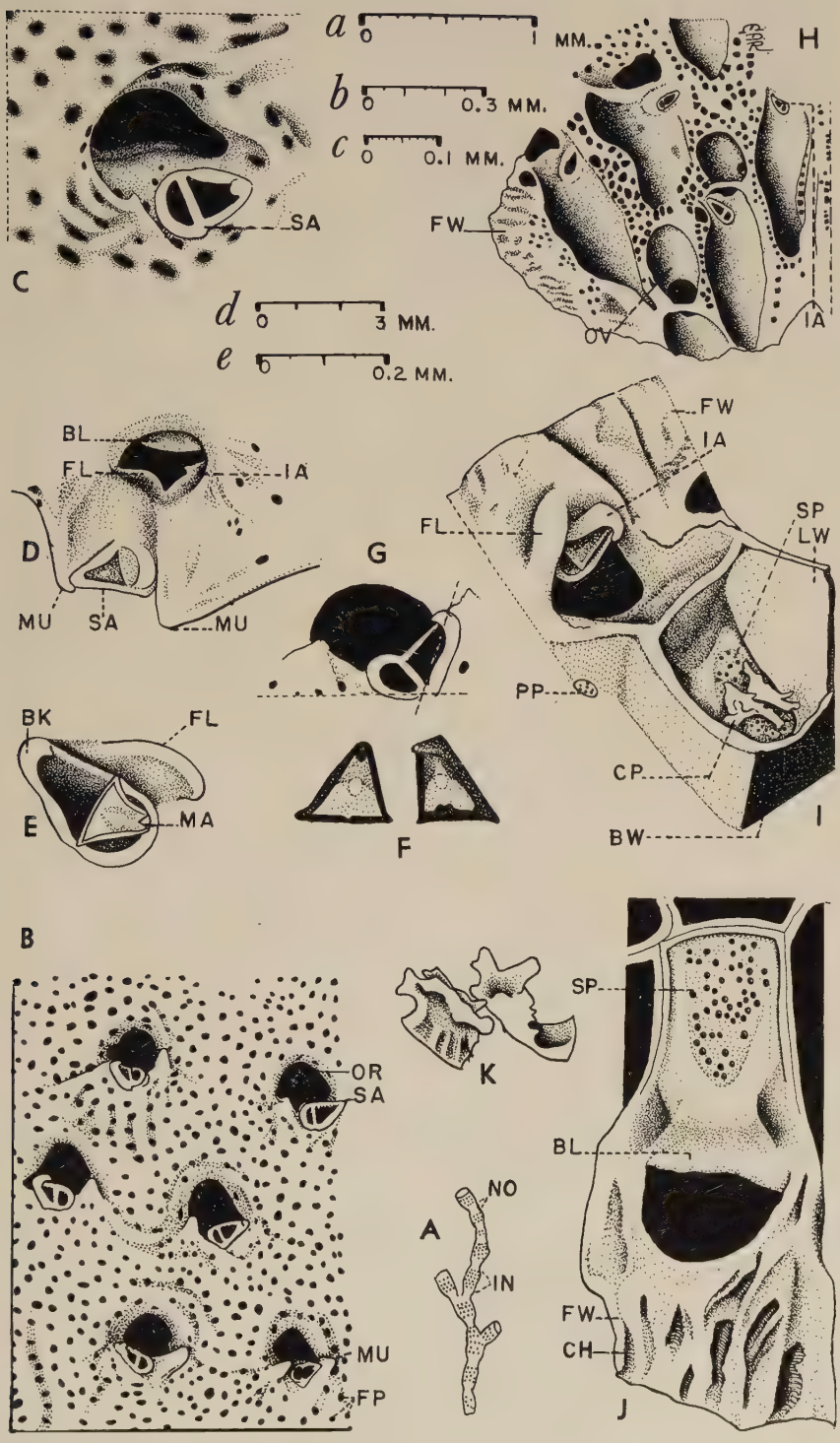
Figure I: Transverse section stereogram through parts of three zooecia. Zoid at extreme left is cut through to show diagonal frontal oral ledge and inner avicularium. Lower right zoid is cut to show deep down its end (proximal) wall with sieve plate, over which project two calcareous processes. Pore plate identifies lateral wall. Scale *b*.

Figure J: Transverse section through a zooecium at level of sieve plate and back ledge, looking up at distal or end wall. Note thickness of frontal wall as compared with other walls, also its channeled nature. Scale *b*.

Figure K: Set of old, heavily calcified processes which occur over a sieve plate in end wall of a zooecium. Scale *c*.

Abbreviations used on plates 12–18

AC, avicularial chamber
AR, areolar pores
BC, zooecial cavity
BK, beak of avicularium
BL, back ledge
BW, back wall
CH, channels or canals leading in from frontal pores
CP, calcareous processes
CR, chitinous rootlets
FL, frontal oral ledge
FP, frontal pores
FW, frontal walls
IA, internal avicularium
IN, internode
LW, lateral wall
MA, mandible
MS, muscle fibers
MU, mucro or umbo
NO, node
NZ, nonovicelled zoid
OL, olocyst
OR, orifice or zooecial aperture
OV, ovicell
PP, pore plate or rosette plate
PV, peristomial visor
SA, external avicularium
SL, second calcareous layer or tremocyst
SO, secondary orifice
SP, sieve plate of end wall



EXPLANATION ON OPPOSITE PAGE

Plate 13

Cellarinella rossi, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

Figure A: Colony sprig showing two internodes and nodes. Scale *d* of plate 12.

Figure B: Enlargement of internode showing six zooecia. Some frontal pores are in slight swirling grooves. Zooecial boundaries indeterminable externally. Scale *a* of plate 12.

Figure C: Zoid frontal wall as seen from inside. Central area of upper frontal expanded and imperforate, lower frontal narrower and perforated by many frontal pores. Two small calcareous processes project over a sieve plate in end wall. Region of orifice, oral ledge, and internal avicularium were obscured by broken fragments so are blacked out here. Scale *b* of plate 12.

Figure D: The strongly arched peristome is flanked on one side by a very tall, sharply pointed, naked mucro; on the other by a lower, avicularium-bearing mucro. Lower proximal edge of orifice is asymmetrical. Scale *b* of plate 12.

Figure E: Inner surface of zoid, in vicinity of orifice, shows shape and size of internal avicularium and its position relative to diagonal frontal oral ledge. Scale *c* of plate 12.

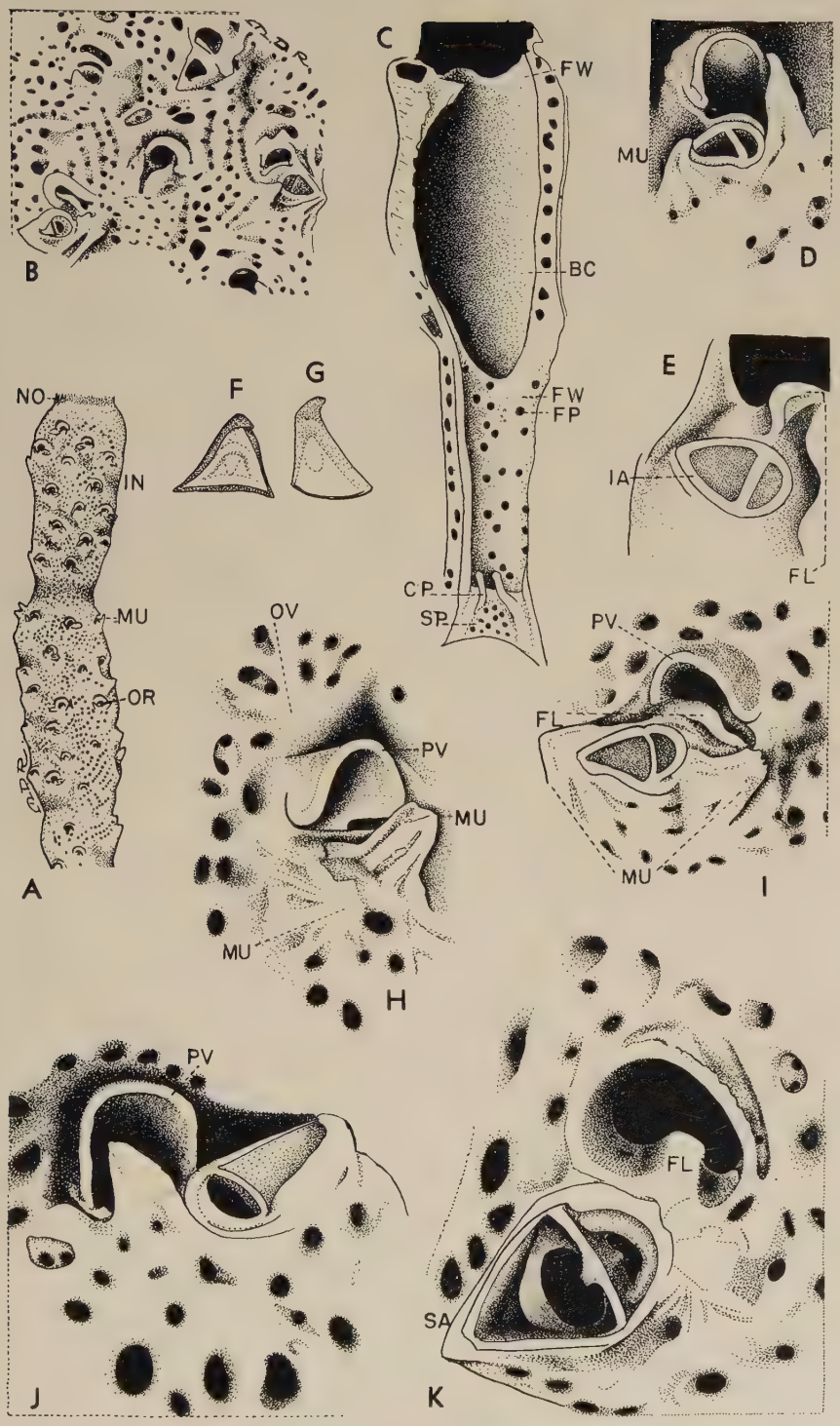
Figures F, G: Two external avicularial mandibles drawn directly from their places in the colony (i. e., not dissected out). Rims and curved tips are chitin-reinforced. Scale *e* of plate 12.

Figure H: Peristomial area seen from side. A very well developed, calcareous, visorlike peristome shades the orifice. To one side of it is a prominent mucro. The other mucro is barely indicated diagonally downward from the left. Above the peristome is nonporous area under which lies the ovicell. Peristomeal visor extends considerably beyond primary orifice. Scale *b* of plate 12.

Figure I: View, slightly from the side, of nonovicelled zoid tipped downward to show asymmetrical orifice with its diagonal frontal oral ledge that contributes to the almost channeled effect at lower right corner. The "channel" is on same side of longitudinal midline as internal avicularium and on opposite side of midline from the external avicularium. Peristome in this zoid is not so well developed as that in figure H but still is of considerable size. Scale *b* of plate 12.

Figure J: Nonovicelled zoid tipped backward and a bit sideways to show shape of stout bare mucro and medium-sized peristome. Avicularium-bearing mucro may be on either right or left side of orifice. Here it is shown at opposite side from those in figures D and I. The avicularium does not point downward in this zoid. This avicularium direction is not common. Scale *e* of plate 12.

Figure K: Nonovicelled zooecium tipped forward so interior of orifice is visible. The peristome is worn down or broken off in this well calcified specimen; diagonal frontal oral ledge is quite thick. The internal avicularium, not visible, is behind and below this ledge but is invisible from this view; a mucro is over this area. External avicularium is heavily calcified and has a strong cross-bar against which the mandible would normally rest. One of the larger avicularia of the colony. Scale *c* of plate 12.



EXPLANATION ON OPPOSITE PAGE

Plate 14

Cellarinella nutti, new species

(For explanation of abbreviations see key for plate 12)

Figure A: The broadest, most perfect colony fragment, 20 mm. long. Its orifices are represented by dots.

Figure B: Enlargement of node and surrounding internode areas of colony in figure A, showing 12 orifices, 5 above node area and 7 below. Scale *a*.

Figure C: More detailed view of three zooecial orifices. The large external avicularium is cradled between two mucros. Within the orifice is visible the partial partition composed of side wall of internal avicularium and inner frontal oral ledge. Scale *c*.

Figure D: Three old heavily calcified zoids near base of colony shown in figure A. External avicularium is deeply sunken in this part of colony. Scale *a*.

Figure E: Another orifice from the colony in figure A, tipped forward about 45° so its internal avicularium can be seen. An external avicularium is lacking in this zoid. Scale *d*.

Figure F: Another zoid from colony of figure A: tipped to show external and internal avicularia. Latter is propped against inner oral ledge. Scale *d*.

Figure G: End view of colony fragment cut through at an internode, showing zooecial cavities of 21 or 22 zoids and end walls of two more. Back and side walls are thin, frontal walls thick. Triangular beaks of three external avicularia jut out from frontal wall. Between the two transversely placed internal avicularia are end walls and sieve plates of two more zooecia. Corrugations of frontal wall are channels leading to some of external and internal pores. This figure shows the bilaminate arrangement of the zooecia with most zooecia opening out on the two faces and relatively few on the edge. This is characteristic of the broad blade, slablike species of this genus. Scale *a*.

Figure H: Looking head-on at an orifice (not tilted). Within orifice is proximal partition formed by side walls of internal avicularium and frontal oral ledge. From this view the external avicularium ls considerably foreshortened. It is also on an umbo which was difficult to show because of the angle. Scale *b*.

Figures I, J: Mandibles of two external avicularia. Details of chitin-reinforcement, lucida, and curvature not shown as specimens were not dissected out. Scale *d*.

Figure K: Transverse section through two zooecia. Lower one is cut at level of its external and internal avicularia, zooecial cavity, front oral and back ledges. Upper one is cut at level of end or proximal wall with its two calcareous processes and the sieve plate. Scale *b*.

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Plate 15

Cellarinella njegovanae, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

Figure A: A typical, flattened, slablike, branched colony. Nodes are left white, internodes are dotted. Dots represent orifices. Chitinous rootlets are near colony base. Scale *a*.

Figure B: Another, smaller colony. Scale *a*.

Figure C: Enlargement of part of internode showing 14 orifices, each with pair of suboral external avicularia. Scale *a* of plate 12.

Figure D: Inner surface of frontal wall of a zoid. The obliquely placed internal avicularium with its hooked, gaping mandible is at upper left in the cavity. Frontal oral ledge is high and hides the internal avicularium from external view. At midright is stretch of porous wall belonging to another zooecium. Scale *b* of plate 12.

Figure E: A young, not-too-heavily calcified, ovicelled zoid. Part of upper lip or distal border of orifice is damaged, broken away. Because of light calcification the ovicell chamber is faintly visible beneath frontal pores. Scale *b* of plate 12.

Figure F: Inner frontal surface of young, lightly calcified zoid. Upper frontal is smooth-walled and expanded. The lower frontal is narrower and porous. Two calcareous processes overhang the basal sieve plate. Scale *b* of plate 12.

Figure G: Sagittal section of heavily calcified, ovicelled zooecium. Frontal wall is of variable thickness; compare with figures E and H. Scale *b* of plate 12.

Figure H: A stereogram of parts of three zoids, showing differences between the thin, smooth, and relatively nonporous back walls, the thin, porous lateral walls, and the thick, channeled frontal walls. The few large rosette plates are characteristic of lateral walls, which also have numerous pores arranged in a few rows near edge next to frontal wall. Scale *b*.

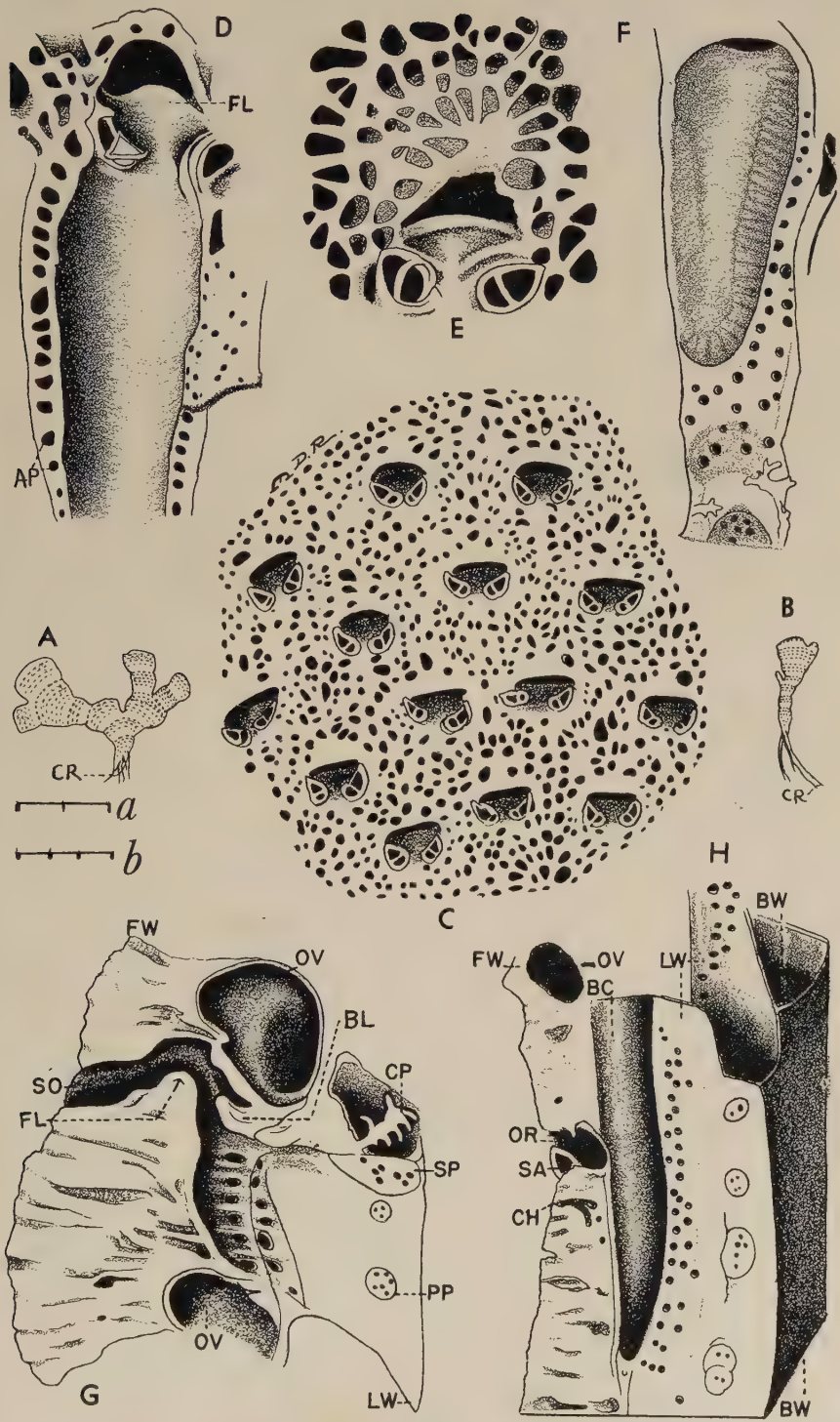

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Plate 16

Cellarinella njegovanae, new species, and *C. roydsi*, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

Figure A: *Cellarinella njegovanae*, new species. Three zoids of medium calcification. Upper lip of orifice forms a faintly bulging horizontal pebbled roof over the deeply buried oral ledge, here heavily shaded. Scale *b* of plate 12.

Figure B: *C. njegovanae*. External avicularial mandible with hooked tip, and oval lucida area. Scale *c* of plate 12.

Figure C: *C. njegovanae*. Young zoid. Arched distal lip is characteristic of a young orifice. Compare with orifices of older zoids shown in figure A. Scale *e* of plate 12.

Figure D: *C. njegovanae*. Primary orifice of a just-forming zoid, which is so young that external avicularia are not yet formed. Zoid is located at distal growing tip of colony. Scale *e* of plate 12.

Figure E: *C. njegovanae*. End walls of two zoids. A pair of heavily calcified processes arch over sieve plates, which are here heavily shaded but not shown in detail. Scale *b* of plate 12.

Figure F: *C. njegovanae*. Sieve plate as seen from underside, the side away from the pair of calcareous processes. Scale *b* of plate 12.

Figure G: *C. njegovanae*. External avicularial mandible. Back area shown in solid black for comparison of size and shape. Scale *c* of plate 12.

Figure H: *C. njegovanae*. Cross section of part of branch cut at node, showing the bilaminate, flattened character of the colony. Chief difference between sections made at level of an internode (pl. 14, fig. G) and at a node (present figure) is in the reduction of zooecial cavity diameter at node. Only an 18-zoid fragment of the 27-zoid branch cross section is shown here. Scale *a* of plate 12.

Figure I: *C. njegovanae*. A few incomplete zoids in process of formation and the calcification of frontal wall. Lowest zooecium has advanced to stage where suboral avicularial chambers are already outlined. Ovicells are forming on the three biggest zooecia. The frontal wall still incomplete. Two upper zoids are in early stages of frontal wall formation. Frontal wall here consists of two layers. Primary layer, olocyst, is thin, smooth, shiny; secondary layer, tremocyst, is rougher, thick, and porous. Scale *b* of plate 12.

Figure J: *Cellarinella roydsi*, new species. A flat, broad, branching colony with chitinous rootlets at its base. Scale *a* of plate 15.

Figure K: *C. roydsi*. Another, broader, slab that is broken off at basal end and at right branch. Scale *a* of plate 15.

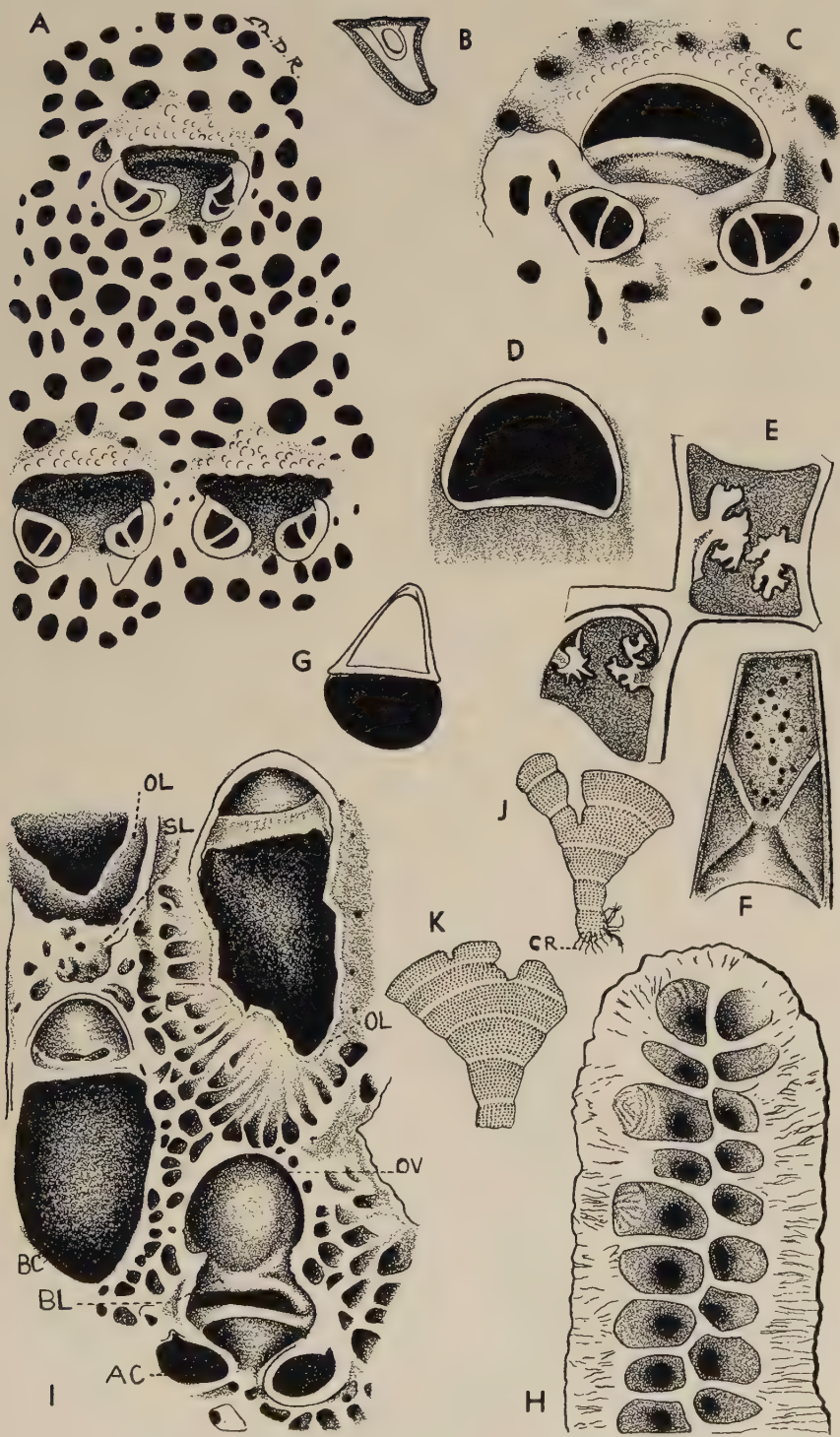

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Plate 17

Cellarinella roydsi, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

Figure A: Part of node, internode, and lateral border of a colony. Mucros jut out prominently from frontal just under orifices. External avicularia missing from two lowest zooecia. Frontal oral ledge and internal and external avicularia show clearly in most of zoids. Scale *a* of plate 14.

Figure B: Two young, lightly calcified zoids. Zoid at right shows partially calcified ovicell wall within the orifice. This wall calcifies by degrees and in sections, as shown. Scale *e* of plate 14.

Figure C: Sagittal section through upper part of ovicelled zoid and parts of its neighbors. Lower lateral wall has two types of perforations—rosette plates and rows of single pores. Scale *c* of plate 14.

Figure D: Sagittal section through an ovicell, orifices, internal avicularial chamber, and the peristomie (the heavily stippled passageway between primary and secondary orifices). Although this colony fragment was completely dry, the mandibular muscles in avicularial chamber were still plainly discernible. Scale *d* of plate 14.

Figure E: Looking down into orifice of a young, lightly calcified zoid to show key characters—the diagonally directed frontal oral ledge and the prominent, highly placed curved beak of internal avicularium. Scale *e* of plate 14.

Figure F: A cross section of several zooecia. The uppermost zoid, just under frontal wall, is cut through the level of frontal oral ledge, back ledge, and internal avicularium. Zoid beneath it is cut at level of its proximal end wall, sieve plate, and two calcareous processes. The other boxlike zoids are cut at various levels between the preceding two. Scale *c* of plate 14.

Figure G: A young, lightly calcified zoid with two external avicularia and a mucro between them. This is a rather uncommon condition, the rule being the presence of one external avicularium. Zoid has been tipped forward so its orifice can be more plainly seen. Scale *e* of plate 14.

Figure H: Another very young, lightly calcified zoid seen from front. Lateral position of the nonaviculariate mucro and transverse direction of the suboral external avicularium are typical for species. Avicularial beak is pointed and hooked. Scale *e* of plate 14.

Figure I: Mandible of an external avicularium. A slight hook is barely indicated at tip. Varying degrees of chitinization, the darkest parts are the most heavily chitinized. Scale *f* of plate 14.

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Plate 18

Cellarinella laytoni, new species

(For explanation of abbreviations see key for plate 12. All figures drawn with aid of camera lucida)

Figure A: Part of an internode. Bottom zoid is without an ovicell, but the five zoids above it show ovicells. Zoids open on all faces of the sprig. Suboral region, with its two mucros, juts out prominently in this species. Degree of calcification is medium. Scale *a* of plate 12.

Figure B: Young, incompletely calcified zoids from tip of a branched colony. The smooth frontal olocyst is encroached upon by the secondary, ridged, porous layer (tremocyst) in the areolar pore region. The strong ribs between the areolar pores, so prominent in the bottom right zoid, become overgrown and indistinguishable with further calcification. The typical prowlike suboral bulge is a key character of this species and shows well on lower right zoid. Scale *a*.

Figure C: Top view of primary orifice of a young zoid near the growing tip of the colony. Beak and mandible of internal avicularium show better here than in figure D, but the external avicularial mandible is dried and a bit twisted out of position here so is not typical. Scale *e* of plate 12.

Figure D: Another young zoid. Avicularial mandible inside orifice is shown from the side; it was heavily stippled to distinguish it. Base of external avicularium straddles the midline. Scale *e* of plate 12.

Figure E: Top end view of a sprig, showing two tiers of zooecia. Areolar pores are visible on the sprawling zoid at left. Scale *a* of plate 12.

Figure F: Part of a sprig which had a "node" and a chitinous rootlet. Scale *a* of plate 12.

Figure G: Base of a fragment with broken-off radicle fiber or rootlet; above that a zoid with two external avicularia, an uncommon condition. Scale *a* of plate 12.

Figure H: Mandible of an external avicularium Scale *b*.

Figure I: Mandible of an internal avicularium. Scale *b*.

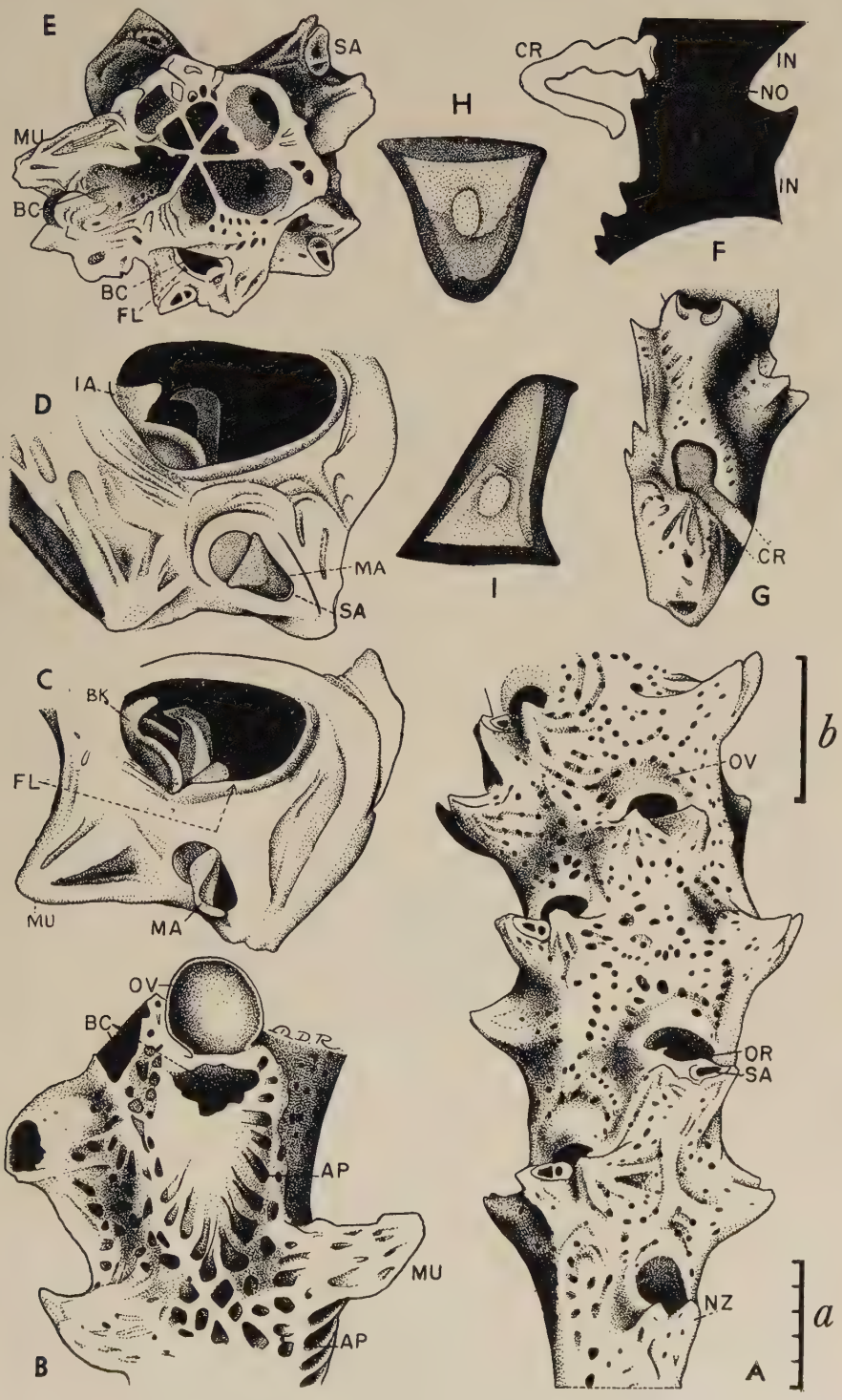

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Plate 19

Umbonula dentata (Waters)

Figure A: Avicularium from side of orifice. Hemispherical mandible is lightly stippled and posterior membranous area is blacked in heavily. Drawn to the 0.1 mm. scale above.

Figure B: Orifice of four zoids, one of them ovicelled. Ovicell incomplete, immature. Bifid denticle and the pair of avicularia at orifice corners are the species' characteristics. Drawn to the 0.1 mm. scale at upper right.

Figure C: A damaged or incomplete frontal avicularium, with mandible deeply immersed, distal to the zooecial orifice, on the next zoid. Same scale as figure B.

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Plate 20

Mucronella crozetensis (Waters)

Figure A: Three zooecia. The peripheral frontal pores, one or two rows, have been enlarged a bit to show them better. Usually they are mere slits, like tiny pin-pricks. Scale *c*.

Figure B: A lyrula of three points and a flat plane where the straight line is. Thickened centrally and longitudinally. Scale *e*.

Figure C: Peristomial fragment, with bases of two hollow hyaline spines. Scale *e*.

Figure D: A calcareous zooecium seen from underneath. The heavy black dots above orifice are spine bases. The heavily stippled radiating canals, yellow or brownish and membranous in actual specimens, connect the mostly torn off membranous base of this zooecium with neighboring zooecia. Scale *d*.

Figure E: An ovicelled zoid with 8 peristomial spines. Ovicell slants back from the peristome. Zooecial peripheral pores shown at sides. Scale *b*.

Figure F: Another ovicell, uncalcined and tipped forward to show the very long and pointed suboral mucro that characterizes young zooecia. The lateral peristomial rim was too obscured and vague to show if and how many peristomial spines were present, so the rim was left unadorned. Other zooecia of the same colony had spines. Scale *a*.

Figure G: Another ovicelled zoid showing texture of the frontal, peripheral pores, and the proportion and position of the ovicell with respect to rest of zoid. Scale *c*.

Figure H: Side view of 3 uncalcined zoids and the membranous (cross-hatched) base of a fourth surrounded by a calcareous rim. The membranous canals or interzooecial connections shown in figures D and K pass through this calcareous border to neighboring zoids. Scale *f*.

Figure I: Peristome, secondary orifice, 7 oral spine bases, and a split 5-point lyrula, seen from the outside. Scale *a*.

Figure J: Primary and secondary orifices, 8 oral spine bases, and a 4-point lyrula, seen from the inside. Scale *a*.

Figure K: Enlargement of the membranous base canals, such as shown in figure D, where the corners of 3 zooecia meet. The 2 lateral zooecia show the canals constricted at the zooecial distal halves. Canals of the proximal corner (upper middle zoid) are not constricted. Scale *g*.

Note: Figures F and H are from natural unremoved specimens; the others are from calcined and slide-mounted material. Figure F is of material from Station 44, figures E and G from rock at Station 184; all others from "Rock 7," station unknown. Each scale represents 0.2 mm.

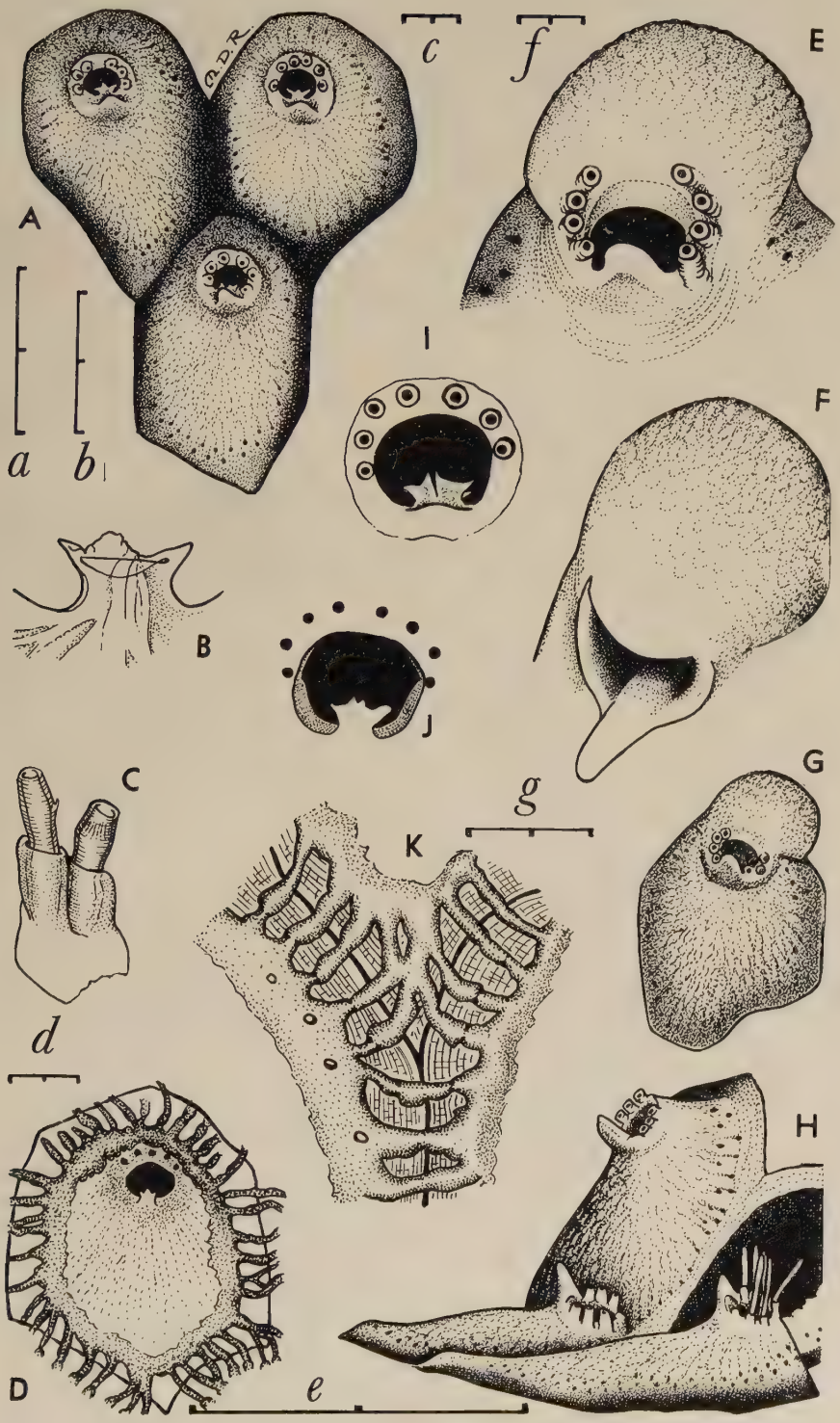

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Plate 21

Parasmittina hymanae, new species

Figure A: Primary and secondary orifices showing cardelles, mucro, and lyrula. Drawn to the 0.1 mm. scale at right.

Figures B and C: Two frontal avicularia showing variations in shape and proportions. Same scale as figure G.

Figure D: Ovicelled and nonovicelled zooecia. Zooecium at left shows the flat upright mucro bordered by a peristomial sinus on each side. Avicularium at left belongs to a neighboring zooecium. Ovicelled zooecium has an avicularium in typical position covering an areolar pore. Ovicell bordered by areolar pores which do not pierce its inner wall. Cardelles do not show. Peristome complete distally in nonovicelled zooecia but incomplete in ovicelled ones. Drawn to the 0.2 mm. scale below.

Figure E: Ten nonovicelled zooecia, some with avicularia, some without. The two rows of areolar pores on the zoid at lower right show regeneration or a second growth after something had interrupted the initial effort. The avicularia always occupy a lateral, peripheral, and corner position over an areolar pore. Drawn to the 0.5 mm. scale at right.

Figure F: Secondary orifice and surrounding beaded surface. Same scale as figure A.

Figure G: Mandible. The two darkest patches are sites for muscle attachment. The stippled pointed projection between them is missing in younger mandibles and is merely a case of advanced chitinization. Drawn to the 0.1 mm. scale at right.

Figures H and I: Two opercula of slightly differing shape. Same scale as figure A.

Note: Figures A–F are from a calcined specimen (slide) of Station 184 material. Figures G, H are from "Rock 19" and figure I from "Rock 8", stations unknown.

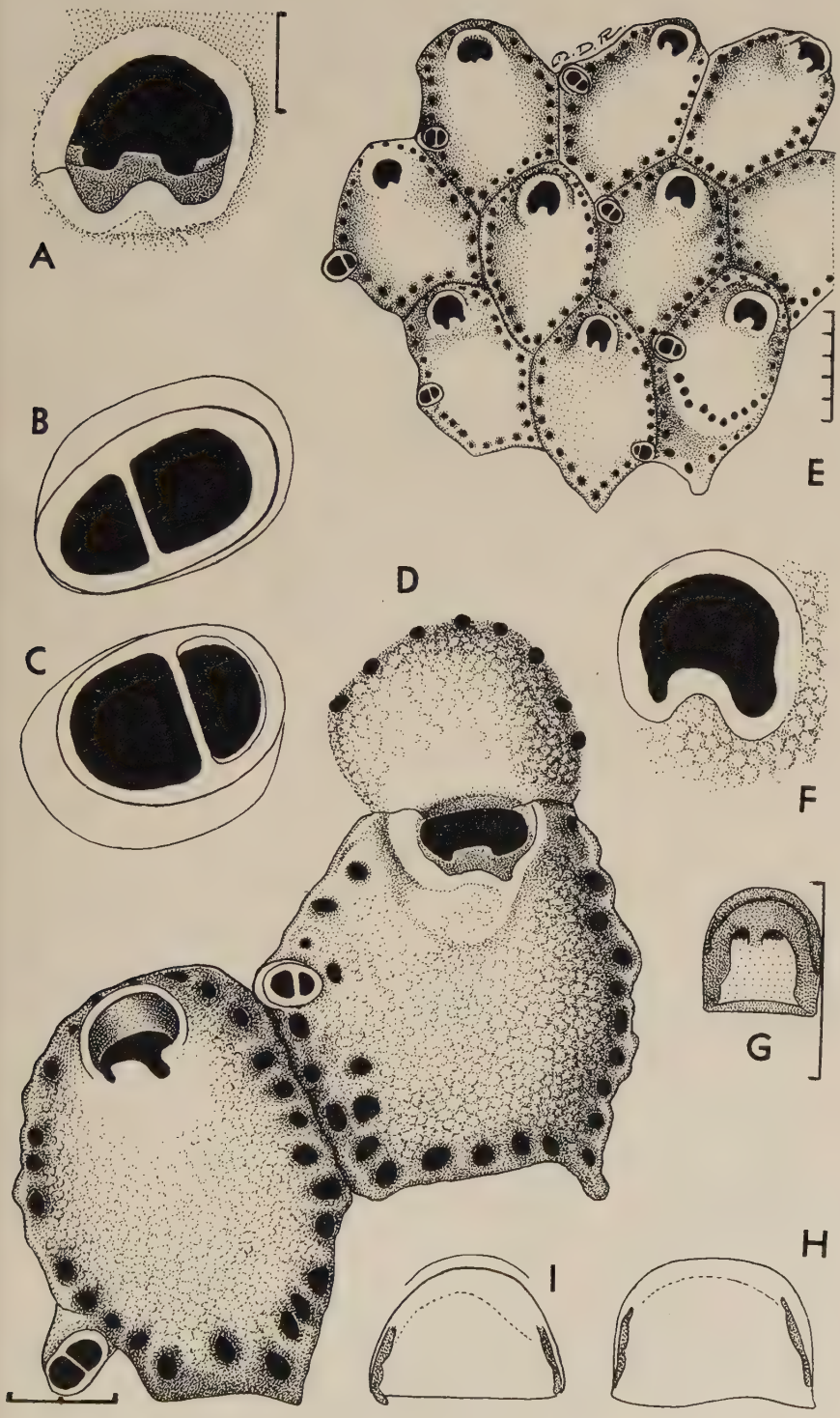

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Plate 22

Rhamphostomella bassleri, new species

Figure A: Ovicelled zooecium with two central frontal avicularia in addition to the customary oral one. Above it is part of a zooecium that has a single frontal avicularium in the lower position. Note the two small, round pores generally associated with the oral avicularial chamber, below and to the back of it. Drawn to the 0.3 mm. scale at left.

Figure B: Nonovicelled zooecium with two frontal avicularia in still different positions. Only the secondary orifice shows in this as well as in figures A and C. Same scale as figure A.

Figure C: Another zooecium with two frontal avicularia placed very proximally. The oral avicularium faces in the opposite direction from the preceding two figures. Same scale as figure A.

Figure D: Side view of two zooecia; lower one with the oral avicularium facing observer, upper left one with the avicularium also mounted on a mucro but facing away from observer with only the mucro showing. Same scale as figure A.

Figure E: Looking down into the primary orifice of a zoid. Upper left part of primary orifice is obscured by a growing peristome. Lyrula and cardelle are typical. Oral avicularium is just below the lyrula, externally. Drawn to the 0.2 mm. scale at left.

Figure F: Oral avicularium with open mandible obstructing the secondary orifice. Same scale as figure G.

Figure G: Oral mandible. Drawn to the 0.1 mm. scale at right.

Figure H: Operculum flattened out. Same scale as figure G.

Figure I: A smaller oral mandible showing the typical tip curvature. Same scale as figure G.

Figure J: Another small oral mandible. Drawn to the 0.1 mm. scale at right.

Figure K: Frontal avicularium. Mandible heavily outlined. Drawn to the 0.1 mm. scale at right.

Figure L: Nonovicelled young zoid showing part of the primary orifice, the growing lateral wings of the peristome and the beginning of the unilateral oral avicularial chamber. Same scale as figure N.

Figure M: Another operculum, not flattened out but in normal position on zoid. Lower border of membrane is indefinite. Same scale as figure G.

Figure N: Interzooecial distal wall, somewhat inverted V-shape. Cellular debris (dark material) found in a number of zoids in adoral chambers. Drawn to the 0.2 mm. scale at left.

Figure O: Ovicelled zoid without any frontal avicularium. Oral avicularium hidden by position of the mucro. Secondary orifice typical. Low oval frontal pit or depression present on some of the ovicells. Same scale as figure A.

Note: Figures A, B, C, and O are from paratype colonies encrusting "Rock 3." Figures D–N are from free foliaceous holotype colony from Station 190.

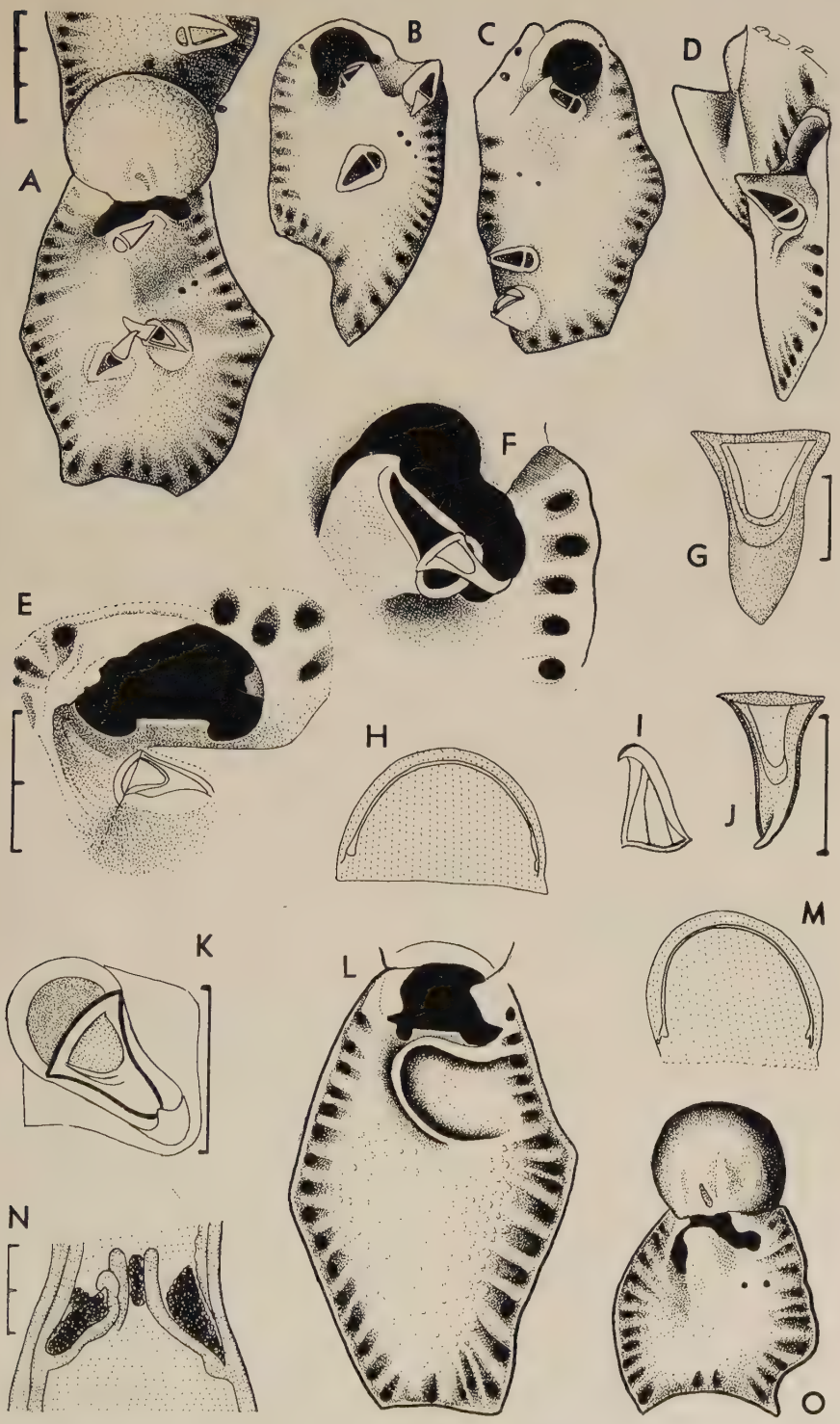

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Plate 23

Smittina abditavicularis, new species

Figure A: Dorsal, attached wall of several zoids. Zoid walls are sharply defined in contrast to the frontal surface as seen in figure D. Drawn to the scale at left.

Figure B: A cross section through three zoids. Frontal wall is at top, dorsal wall at bottom. Zooecial cavity shown in solid black. Middle zoid is cut through the peristomial region with the interzooecial communicating pores exposed. Multiporous plate at extreme left still has its four small pores intact. The peristomial lining is shinier and smoother than rest of zooecial wall. Drawn to the scale above.

Figure C: Enlargement of orifice region. Thin salient mural rims converge toward the clithridiate secondary orifice. Frontal wall (tremocyst) is porous, beaded, and thick. Drawn to the scale at left.

Figure D: Small area of colony showing fused frontal wall of a number of zoids. Here and there raised mural rims can be seen, especially about orifice. Where mural rims are obliterated zooecial boundaries can be identified because marginal frontal pores are often slightly larger and more in alignment than those elsewhere. Drawn to the scale at left.

Figure E: A cross section through the peristome, looking down on the primary orifice, shown in black, which is bordered by a small median lyrula and two broad cardelles. Between the lyrula and secondary orifice, in the peristomial floor, is the obliquely oriented median oral avicularium, the exact boundaries of which are shown somewhat indefinitely. Same scale as figure C.

Figure F: Lyrula and cardelles from inner, dorsal aspect. Black area is the primary orifice. Drawn to scale at left.

Figure G: Somewhat lateral view of peristomial canal and primary orifice (in black) toward which the small lyrula and one big cardelle point. Oral avicularium diagrammatic because its beak shape could not be seen too clearly. Secondary orifice to left of avicularium. Same scale as figure F.

Figure H: Primary orifice, lyrula, and cardelles. Cardelle at left damaged and incomplete. Same scale as figure F.

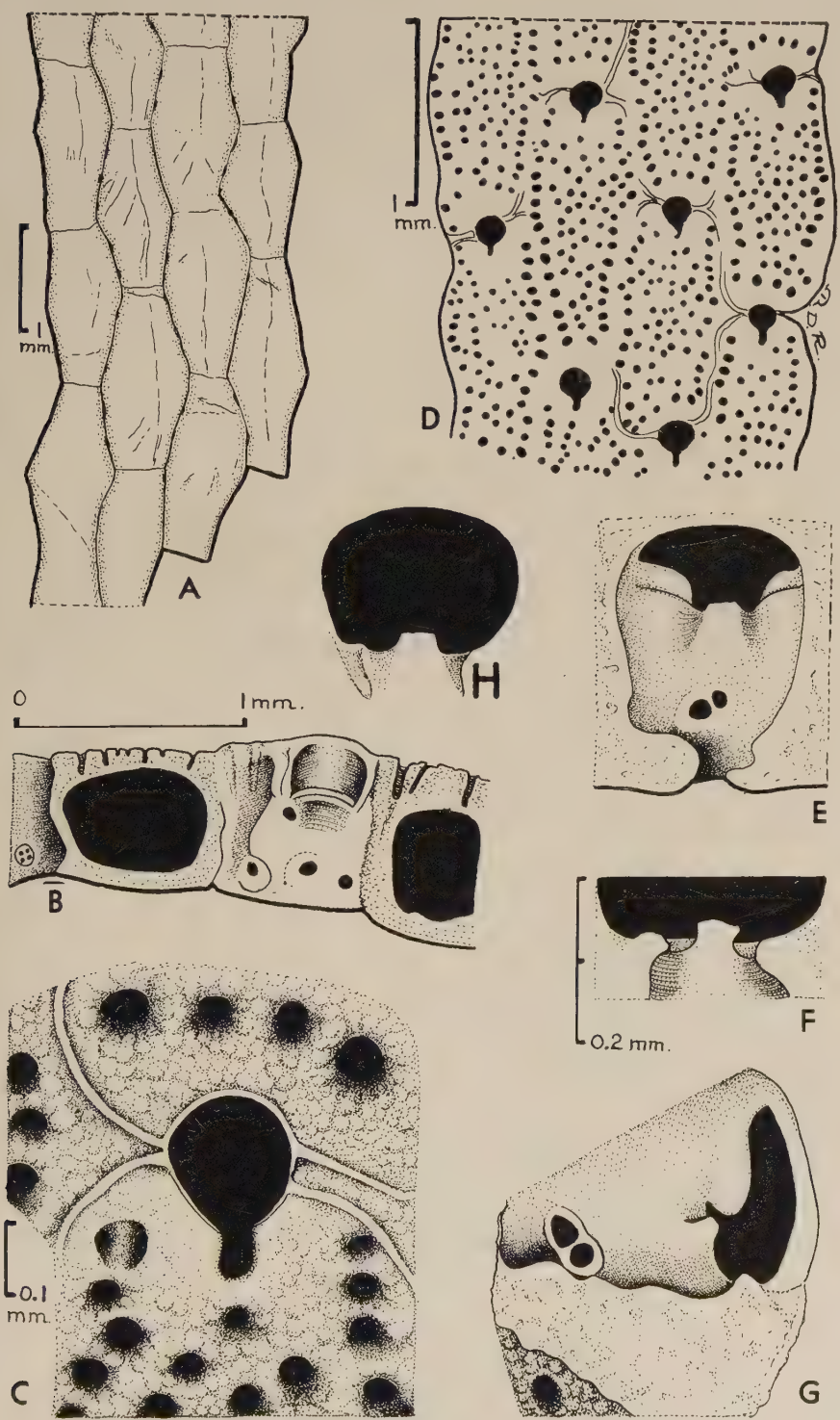

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Plate 24

Smittina alticollarita, new species

Figure A: Primary orifice with a young lyrula that is narrower than the ordinary lyrula, and the usual tall cardelles. Peristome not yet fully developed in height. From holotype colony. Drawn to the scale below figure F.

Figure B: Upper part of a zoid from the same colony; peristome trilobate and elevated; avicularium in characteristic position in peristomial gap. Same scale as figure C.

Figure C: A very young, unthickened peristome, pear-shaped secondary orifice, and peristomial sinus. From holotype. Drawn to the scale immediately below.

Figure D: Older zoid from the same colony, having wider lyrula, a tall cardelle, and an oral avicularium. The right third of the peristome is beginning to flare out. Drawn to the scale below figure F.

Figure E: Flared, elevated, trilobate peristome of paratype. The primary orifice is not pictured exactly because it was debris-choked. Two faintly defined hemispherical structures (?), one below the peristomial gap and the other to one side (dotted), occur on a single paratype zoid but are so vaguely defined that it is not possible to tell if they are avicularia or merely worn, roughened parts of the frontal. In all other respects the paratype agrees with the holotype. Drawn to the scale below figure F.

Figure F: Another zoid from the holotype colony showing a wider peristomial gap than in figure C. Same scale as figure C.

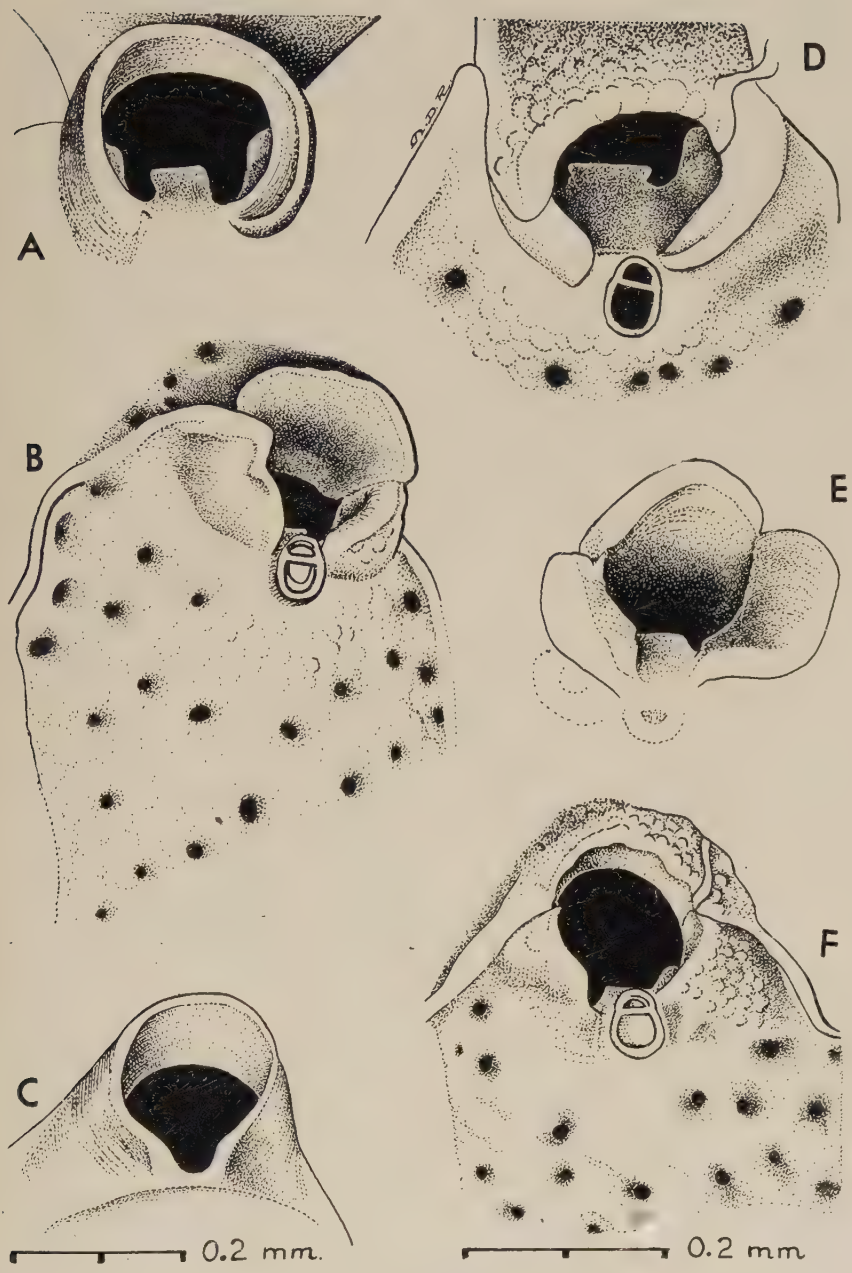

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Plate 25

Smittina canui, new species

Figure A: A young zoid tipped forward to show the lyrula and avicularium. Mandible in place. Peristome incomplete as yet on left side, exposing avicularial tip. Scale *a*.

Figure B: Most typical shape of mature secondary orifice. Lyrula broad. Beak tip of avicularium not fully exposed. Scale *b*.

Figure C: Young primary orifice showing part of one cardelle and the wide lyrula. Avicularial chamber has not yet formed on this individual, which is at the growing edge of the colony. Scale *a*.

Figure D: Somewhat lateral view of young ovicelled zoid. Mandible in place on avicularium. Distinct transverse groove associated with development of avicularial chamber still shows on this zoid just below peristome. Groove becomes obliterated externally in older zoids due to increasing calcification. Peristome has not yet encroached upon sides of ovicell (cf. figure E). Scale *a*.

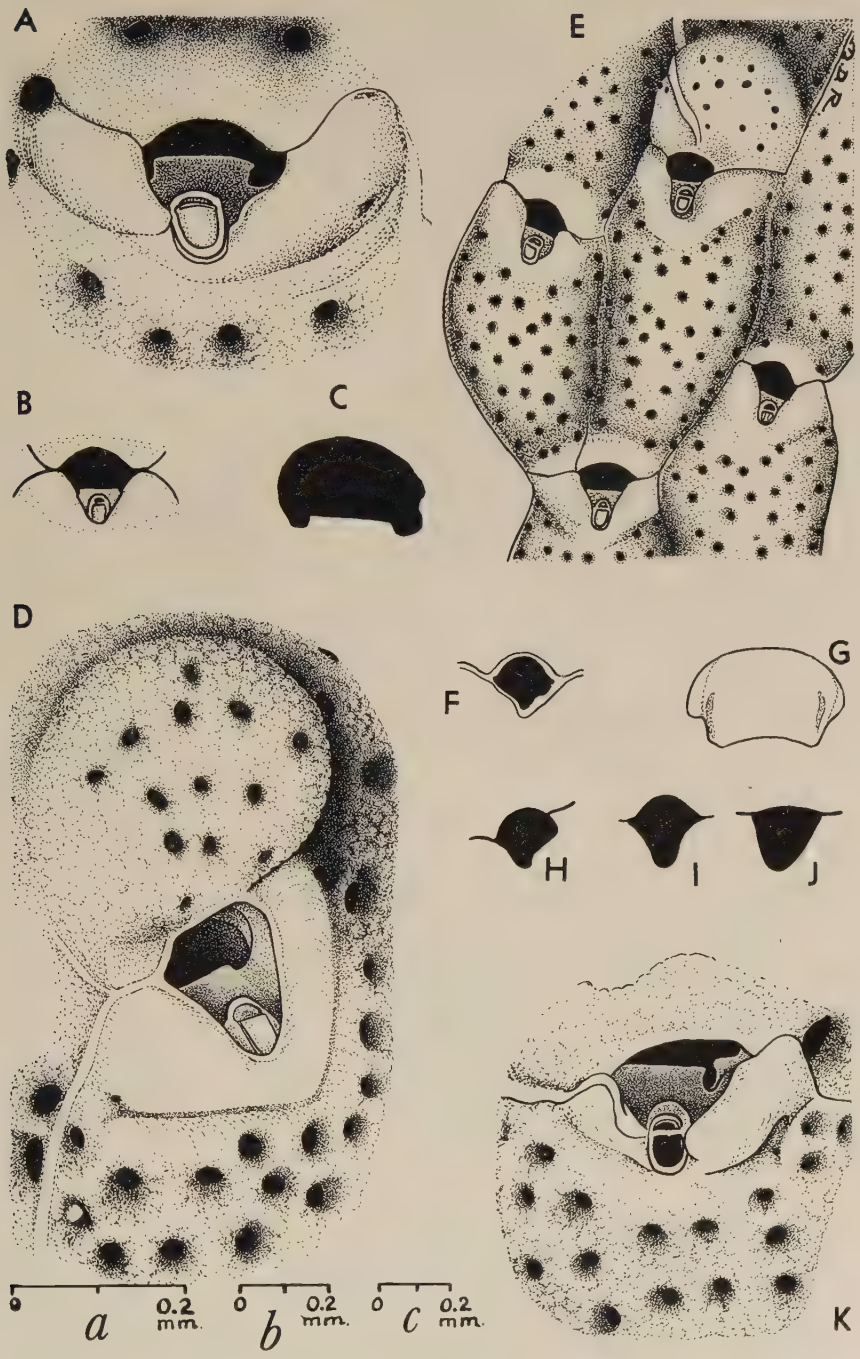
Figure E: Growth habit. One zoid ovicelled. Ovicell marked by a raised mural rim growing over it. Some ovicells show this feature, others do not. Left bottom zoid has two zoid rows arising from it while right zoid has one. Scale *c*.

Figure F: The secondary, heavily calcified, smaller, somewhat misshaped aperture of an old zoid. Scale *b*.

Figure G: Operculum. Scale *a*.

Figures H, I, J: Secondary orifices, variations in shape and size. The two lines extending from each are mural rims or zooecial boundaries. Scale *b*.

Figure K: Orifice of another young zoid tipped to show one cardelle and part of the lyrula. The orifice is a bit lopsided because the peristome is not yet symmetrically completed. Avicularial chamber groove still present. Supporting the avicularium is a small curved raised ledge, seemingly tilted forward. Scale *a*.



EXPLANATION ON OPPOSITE PAGE

Plate 26

Smittina excertaviculata, new species

Figure A: Note convexity of frontal and protrusion of peristome and avicularium. Drawn to adjacent scale.

Figure B: Primary and secondary orifices. The broad lyrula and one cardelle show deep into orifice. The distal third of peristome wall formed by distal zooecium. Drawn to adjacent scale.

Figure C: Secondary orifice of nonovicelled zoid showing avicularium dipping down a bit past the peristome. Same scale as figure F.

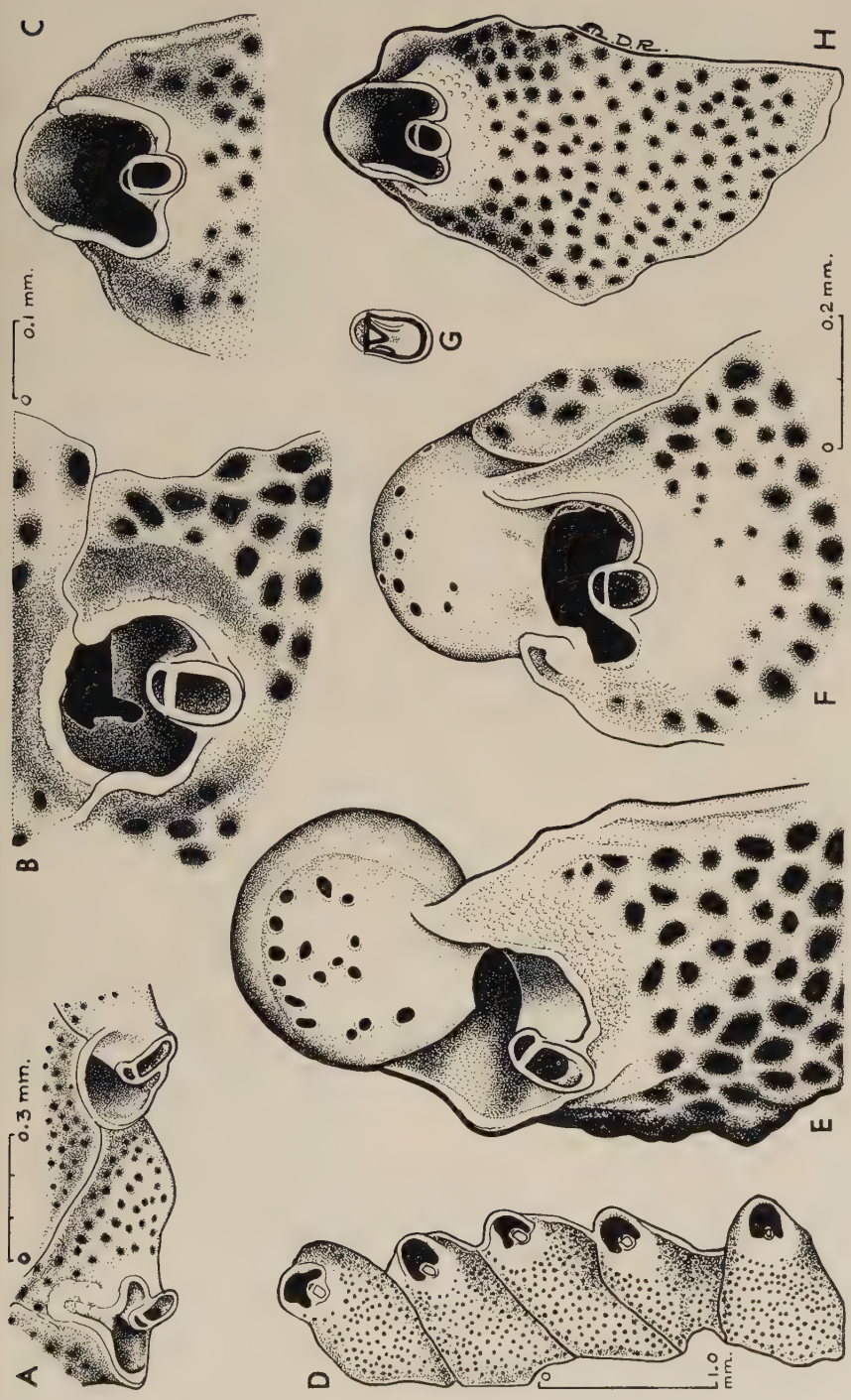
Figure D: Growth habit of 5 nonovicelled zooecia showing elevation of the peristomial area, the protruding avicularia, and the dense porosity of the frontal. Drawn to adjacent scale.

Figure E: Side view of an ovicelled zoid. The characteristic "break" of the avicularial face into two different planes at the pivot (transverse bar) is evident, as is also the gently rounded ridge that leads from the avicularium toward the primary orifice. The crescent-shaped, peripheral, nonporous part of the ovicell wall is a bit thicker than the porous part. Ovicells on the paratype are more encrusted, especially in the peripheral area, than on the holotype here shown. Same scale as figure B.

Figure F: Another ovicelled zoid, drawn from a different angle, is tipped too far back to show the thicker, nonporous peripheral ovicell wall. Peristomial wings encroach upon the ovicell sides. One corner of lyrula barely visible. Drawn to adjacent scale.

Figure G: A spatulate mandible in place on avicularium. Same scale as figure B.

Figure H: A nonovicelled zooecium drawn in its entirety. The avicularium does not extend down quite as far in this zoid as in figures A–C. Same scale as figure A.



EXPLANATION ON OPPOSITE PAGE

Plate 27

Smittina obicullata, new species

Figure A: An old zooecium. Ovicell is partly overgrown by a secondary calcified layer which encroaches first laterally, then more distally across the ovicell. Higher elevation of suboral avicularium above the rest of frontal surface is difficult to show in a frontal view. From Station 234. Drawn to the scale between this figure and figure F.

Figure B: Freehand view of an ovicelled zooecium, from the side. The globose, porous ovicell at left is being encroached upon at the sides by secondary calcification. Collared peristome projects forward and upward, with sinus forming a wide gap in it frontally above the avicularium. Avicularium is on a small plateau of varying elevation above the rest of porous front. Mandibular area approximately parallel with the zooecial base.

Figure C: Six zooecia of holotype colony from Station 190 showing four zooecial possibilities or conditions: zooecia with or without ovicells or avicularia. Peristome variable but above the avicularium, Drawn to scale at left.

Figure D: An operculum with two lateral sclerites for muscle attachment. From Station 226. Same scale as figures A and F.

Figure E: Mandible. Darker parts are more heavily chitinized than paler parts. Mandibular pivot shown in white across top. From Station 226. Drawn to the scale directly above.

Figure F: Oblique view of an operculum and one bundle of muscle fibers attached to the sclerite region. Second muscle bundle is broken off and its stub is at lower right. From Station 226. Drawn to the scale at left.

Figure G: Bilaminate holotype colony. Drawn to the scale at left.

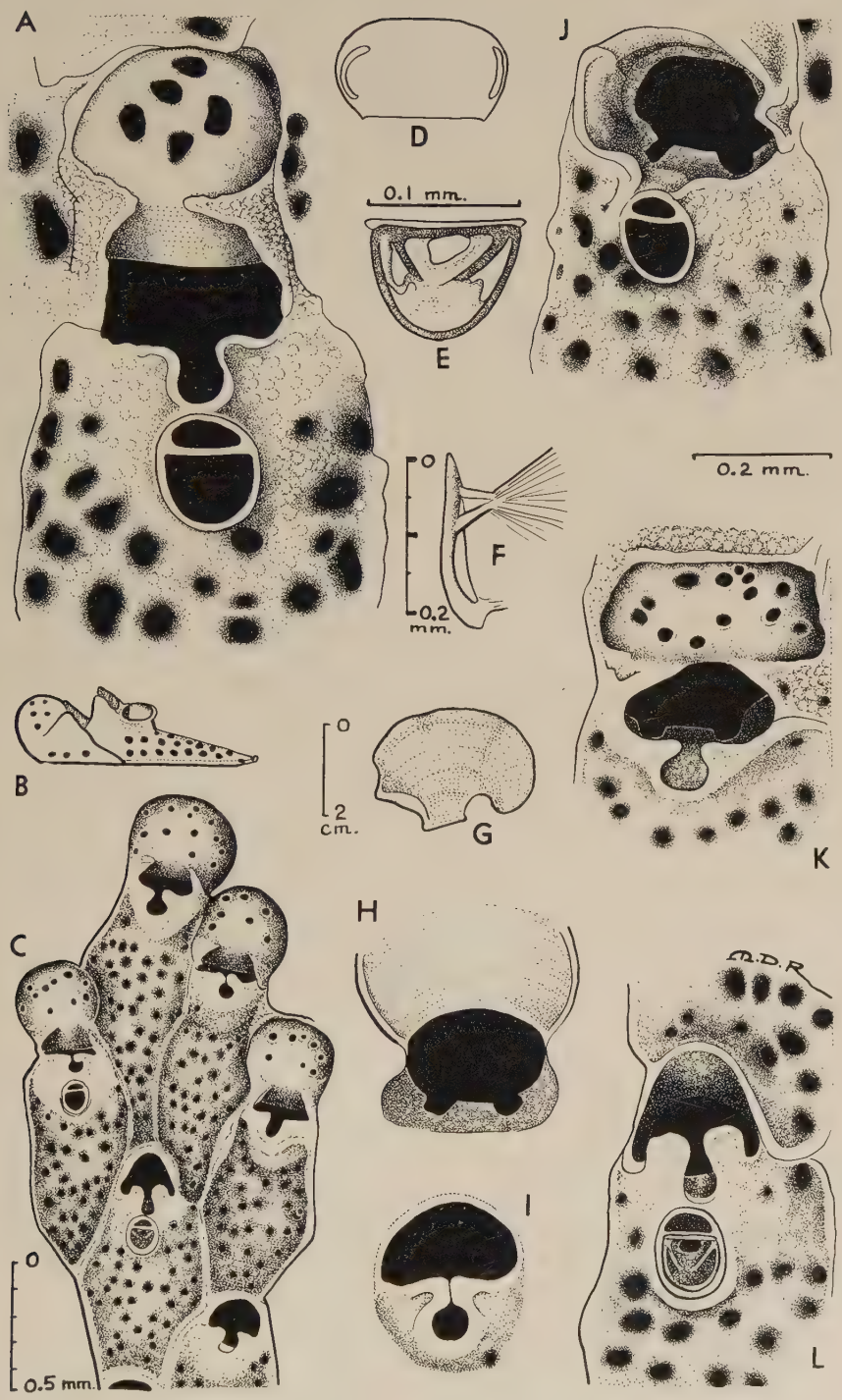
Figure H: Primary orifice and unfinished ovicell of a young holotype zoid. Same scale as figure J.

Figure I: Secondary orifice of a young holotype zoid. Here the peristomial wings nearly touch above the sinus (cf. sinus in figures A, J–L). Same scale as figure J.

Figure J: Old zooecium with worn-down peristome, from same calcined colony as figure A; tipped to show primary orifice, lyrula and cardelles. Drawn to the scale below.

Figure K: Ovicelled zooecium showing increasing secondary calcification at lower corner and distal surface of the ovicell. Zoid and ovicell are in a colony concavity so ovicell frontal seems proportionately much shorter than those of figures A and C. From holotype. Drawn to scale above.

Figure L: Zoid with unusually tall peristomial wings and a mandible in place on avicularium. From holotype. Same scale as figure J.



EXPLANATION ON OPPOSITE PAGE

Plate 28

Smittina oblongata, new species

Figure A: A zooecium showing height of upright peristomial collar and depth of its wide notch. Zooecium tipped away from the observer so wide inner tooth or lyrula is not visible from this angle. Scale *c*.

Figure B: Shallow, spatulate, suboral avicularium. Drawn to scale *d*.

Figure C: Four zooecia, one with suboral avicularium in typical position and orientation. Number, size, and distribtuion of frontal pores depend on degree of zoid calcification. Scale *b*.

Figure D: Sterogram of two zooecia, seen from the side. Back wall (heavily stippled, to left) is flat and thin; side wall, also thin, has pores, 4 belonging to upper zoid, 5 to lower. Sides of frontal wall are roughened or lined irregularly. Scale *a*.

Figure E: Ovicelled zooecium. This figure is incomplete and imperfect because lower part of ovicell, orifice, and peristomial area were obscured by debris, indicated by the cross-hatching over that area. Also, zooecium was at a broken-off edge of the colony and ovicell had lost part of its secondary calcification layer. Scale *c*.

Figure F: Primary orifice, median lyrula, and two wedge-shaped cardelles. Scale *d*.

Figure G: Zooecium with heavily calcified peristome, deeply located lyrula, wide peristomial notch or sinus. Scale *d*.

Figure H: Cross section through a zooecium showing relative thickness of walls. Basal and side walls are thin, frontal wall thicker, mural rim or border thin and raised. Zooecial cavity shown in black. Scale *c*.

Note: Figures A, D–H are from paratypes; B, C from the holotype.

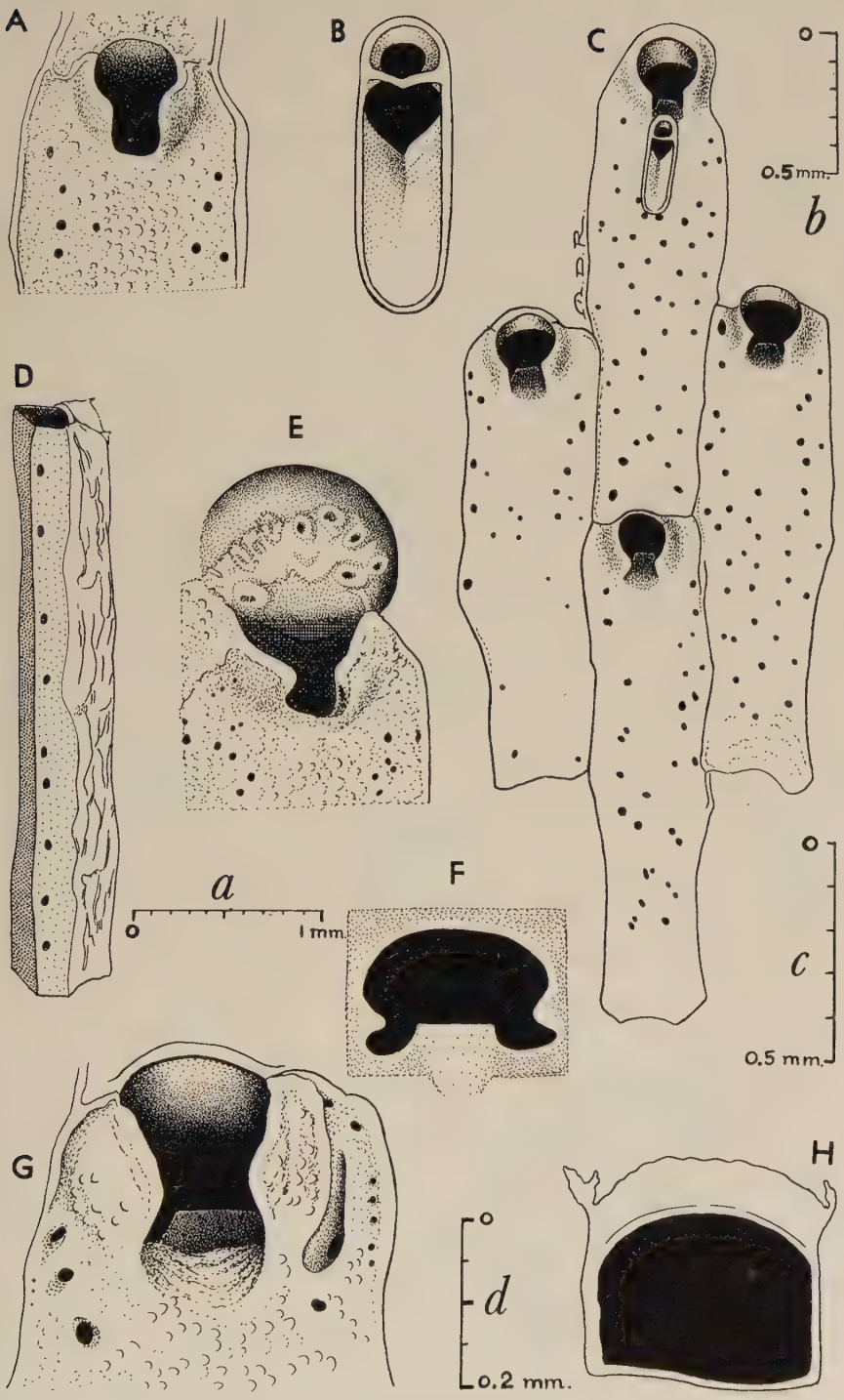


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Plate 29

Smittina ordinata (MacGillivray)

Figure A: Side view of two zoids. Protrusion of peristome and ovicell rim is characteristic. Drawn to scale at left.

Figure B: Zooecium tipped forward to show lyrula, cardelles, and oral avicularium. Drawn to scale at left.

Figure C: Operculum. Same scale as figure D.

Figure D: Another operculum from the same colony. Drawn to scale below.

Figure E: Colony, showing ovicelled and nonovicelled zooecia. Drawn to scale at left.

Figures F–I: Range of secondary orifice variation in the same colony. Oral avicularium is present in the first three but does not show because of angle at which viewed. Perhaps the most typical orifice is figure G. All drawn to scale below.

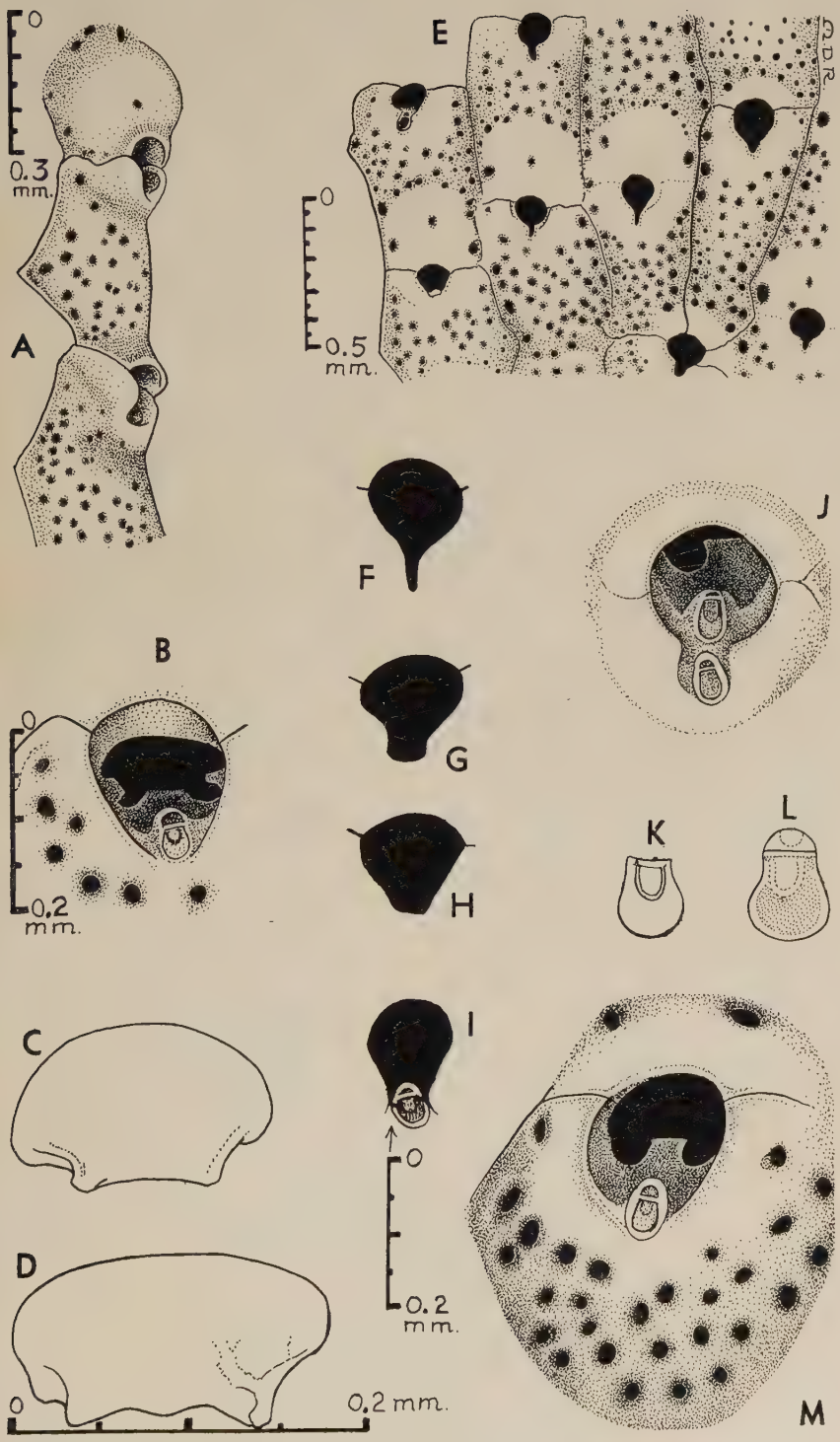
Figure J: An anomaly, two oral avicularia, was found in two neighboring zoids. Same scale as figure B.

Figure K: Mandible. Same as figure D.

Figure L: Mandible and covering over the membranous back area of avicularium. Same scale as figure K.

Figure M: Young, recently formed zoid with narrower lyrula and no cardelles yet. Same scale as figure B.

Note: Figures C, D, K, and L are from Station 226 balsam slide preparations. The rest are from Station 240. Figures A and J are from uncalcined colonies, the remainder are from calcined material.



EXPLANATION ON OPPOSITE PAGE

Plate 30

Smittina ordinata (MacGillivray)

Figure A: Very young zoid with four oral spines, lyrula, cardelle, and an incomplete peristome. The spine bases extend into the calcifying peristomial band at this still-transparent wall stage. Peristome incomplete proximally, lacking avicularium. Triangular ledge against which the avicularium would have rested is in front of the lyrula. Drawn to the 0.1 mm. scale at upper left.

Figure B: Another young zoid but with three spines, lyrula, cardelle, and frontally incomplete peristome. Avicularial chamber develops in shaded frontal area under the incurved triangular peak. Drawn to the 0.2 mm. scale at upper right.

Figure C: Another young zoid, with four spines and oral avicularium. The latter leans against the triangular oral process shown in preceding figures. Same scale as figure B.

Note: The material figured on this plate is from Station 226.

EXPLANATION ON OPPOSITE PAGE

Plate 31

Smittinella rubrilingulata, new species

Figure A: The peristomial sinus, its two supporting ledges, lyrula, and small triangular ante-lyrula process (support for a probable future avicularium?). Drawn to the 0.1 mm. scale at right.

Figure B: Tangential view of secondary orifice, peristome, sinus and one of its supporting ledges. Drawn to the 0.1 mm. scale at left.

Figure C: Inside view of the lyrula, the reddish ante-lyrula triangular process, the two lateral supporting peristomial ledges, and (blacked-in) peristomial sinus. Same scale as figure A.

Figure D: Three zooecia and ovicell. Drawn to the 0.3 mm. scale at left.

Figure E: Side view of peristome and sinus. Same scale as figure B.

Figure F: Another inside view of the lyrula, lateral peristomial ledges, ante-lyrula process, and porous frontal. Same scale as figure B.

Figure G: Looking into the primary (blacked-in) and secondary orifices. Lyrula in the background. Same scale as figure B.

Figure H: Ovicell and peristome detail. Drawn to the 0.2 mm. scale at right.

Figure I: Detail of peristome, possible avicularial chamber? (the stippled, axe-shaped central area), and its ante-lyrula tip. The tip is usually a deep rose color, i. e., the most intense color of the zoid is concentrated about this tip, inside the orifice. Peripheral pores are generally somewhat larger than the other frontal pores. Same scale as figure B.

Figure J: Freehand, reconstructed diagram of primary orifice as seen from the inner surface. Distal vestibular arch is a larger ellipse than the proximal part housing the lyrula. The two knobs at the corners are not cardelles but the ends of the supporting peristomial sinus ledges.

Figure K: Freehand diagram of undersurface of a zooecium, showing exact distribution of membranous interzooecial connections. These tubules are wider and less numerous than those of *Mucronella crozetensis* (cf. plate 20, figures D,K).

Note: The material figured on this plate is from Station 184.

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Plate 32

Smittoidea evelinae (Marcus)

Figure A: One complete nonovicelled zooecium, parts of four other zooecia, and two ovicells, all well calcified. Drawn from calcined specimen from Station 230 to scale at upper left.

Figure B: The largest, hollow, trumpet-shaped colony from Station 234. On its inner surface are calcareous worm tubes and bryozoan colonies (as *Ramphonotus inermis*, etc.). Drawn to scale at left.

Figure C: Mandible from colony in figure B. Chitinous reinforcements in white, thinner parts stippled. Both the lower hemispherical mandible and upper membranous covering of the avicularial-back-membranous area are shown for size comparison. Drawn to scale at left.

Figure D: Primary and secondary orifices tipped forward to show relation of horizontal avicularium to lyrula and peristome. Gentle curvature of distal border not seen because of tipping. Drawn from material from Station 230 to the scale at right.

Figure E: Four zooecia and two incomplete ovicells of which only the inner lining shows. One to two rows of frontal alveolar pores are indicated. Drawn from the colony shown in figure A to the scale at upper left.

Figure F: Operculum, its marginal reinforcements and occlusor muscles. Drawn from colony shown in figure B to the same scale as figure D.

Figure G: Primary orifice, two cardelles, lyrula, and oral avicularium within bounds of the peristome. From colony shown in figure B. Same scale as figure D.

Figure H: Less heavily calcified ovicell than in figure A. Same scale as figure A.

Figure I: Another colony from Station 234. Its wide but thin, flattened stem is solid, the zooecia growing back to back, in bilaminate fashion. The unilaminate sides flare out into shape of a cup. Inside the cup grow *Ramphonotus inermis* and calcareous worm tubes. Same scale as figure B.

Figure J: Zooecium tipped forward to show lyrula, oral avicularium, operculum covering the orifice, and an extended platform on which the oral avicularium rests. This zooecium is tipped so far forward that the operculum (heavily stippled) is very foreshortened. Drawn from fragment from Station 234 to same scale as figure D.

EXPLANATION ON OPPOSITE PAGE

Plate 33

Smittoidea ornatipectoralis, new species

Figure A: Ovicelled zoid tipped slightly forward to better depict the lyrula, cardelles, and primary orifice. Suboral avicularium is always close to peristomial notch, which is always between it and the lyrula. Drawn to scale at right.

Figure B: Nonovicelled zoid. Peristomial notch shows but the lyrula and cardelles are hidden behind it because zoid is not tipped forward. Drawn to scale at left.

Figure C: Primary orifice (blacked in) with median lyrula and the two cardelles. Drawn to scale at right.

Figure D: Four zoids, two ovicelled, two not, with raised mural rims and large suboral avicularia. Drawn to scale at left.

Figure E: A suboral avicularium. The pivotal bar separates the very small nearly hemispherical membrane-covered area from the very large, broad, oval mandibular (beak) part. An extensive mandibular shelf forms a floor under most of beak. Floor buckles upward in central region then dips down like a trough peripherally; in other words, convex. This condition not shown here but is in figures A, B, and D. Drawn to scale above.

Figure F: Tangential view of three zoids with varying degrees of frontal wall protrusion in suboral avicularium region. Ordinarily, the mound bearing the avicularium is very small. Drawn to the 1 mm. scale at right.

Note: Figures A–E drawn from holotype from Station 45; figure F from calcined paratype from Station 44.

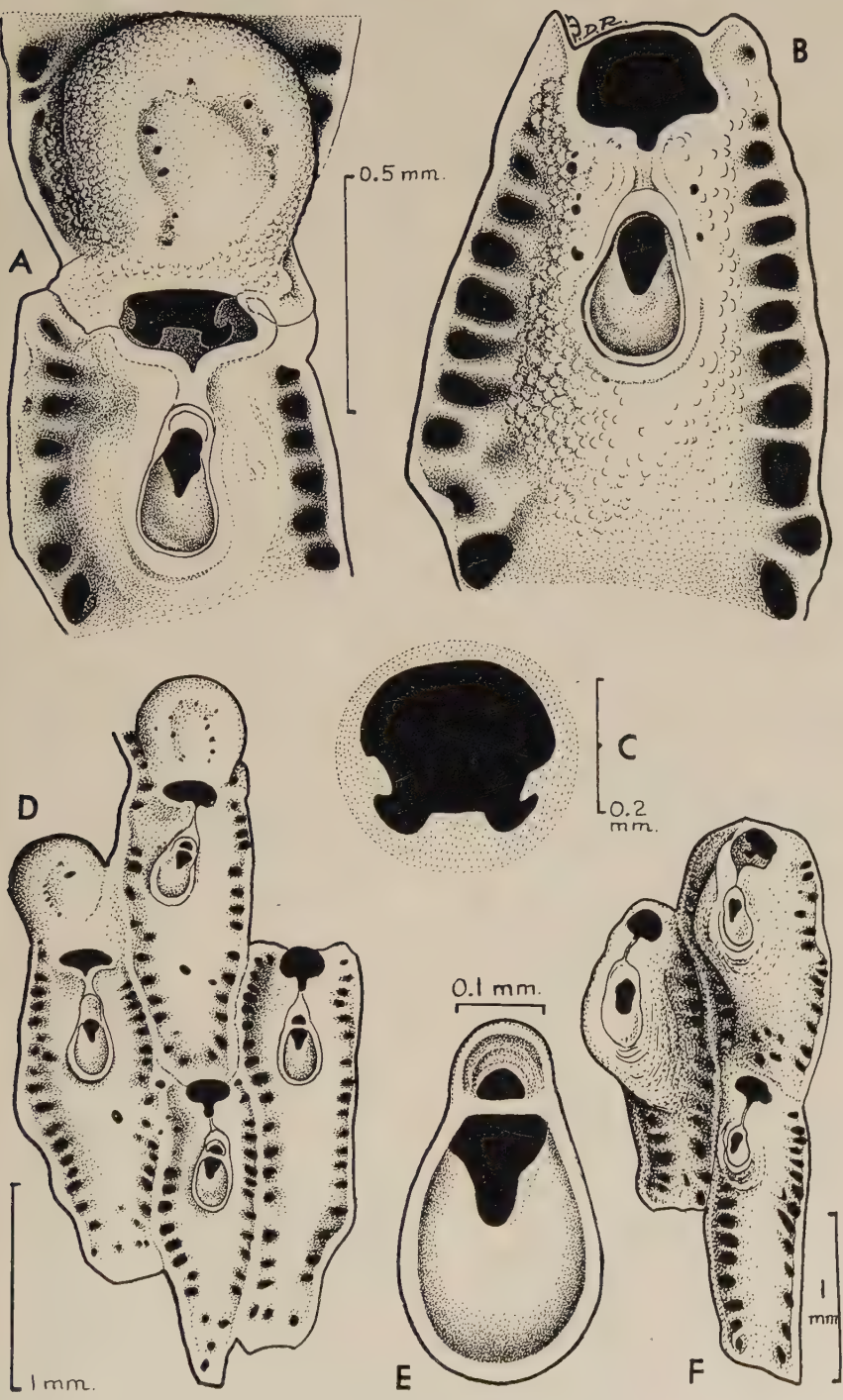

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Plate 34

Smittoidea ornatipectoralis brevior, new subspecies

Figure A: One of the largest avicularia. Note the broad, short distal area and relatively longer pivotal bar in this subspecies as compared with the avicularia of the preceding form (cf. pl. 33, E). Drawn to scale at right.

Figure B: A chitin-reinforced mandible of one of the smaller avicularia. It measures 0.158 mm. X 0.187 mm. More heavily chitinized parts are darkened. Same scale as figure A.

Figure C: The operculum and its musculature. The more heavily chitinized parts are darkened. Same scale as figure A.

Figure D: A zoid beginning to form an ovicell, which is very incomplete as yet. An operculum covers the orifice, its sclerites very evident; lyrula also visible. This is one of the largest avicularia seen in this form. Drawn to the scale at right.

Figure E: Another zoid, which has both operculum and avicularial mandible in place. Raised plateau on which suboral avicularium is mounted is outlined or punctured by occasional small pores, three of which are here pictured (two at right and one below). Opercular chitinous reinforcements are not as advanced as those of figure C. The broad median lyrula and one cardelle are visible through the operculum. The mandibular sclerites form a Y here and are better developed than those of figure B. Same scale as figure A.

Figure F: The primary orifice, two inwardly directed cardelles, and worn-down lyrula of an older zoid, seen from the inside. Drawn to the 0.3 mm. scale at right.

Figure G: Seven zooecia, some of which are beginning to form ovicells. Drawn to the scale at lower right.

Note: Figure F is from a colony from Station 44. Remaining figures are from the holotype from Station 226.

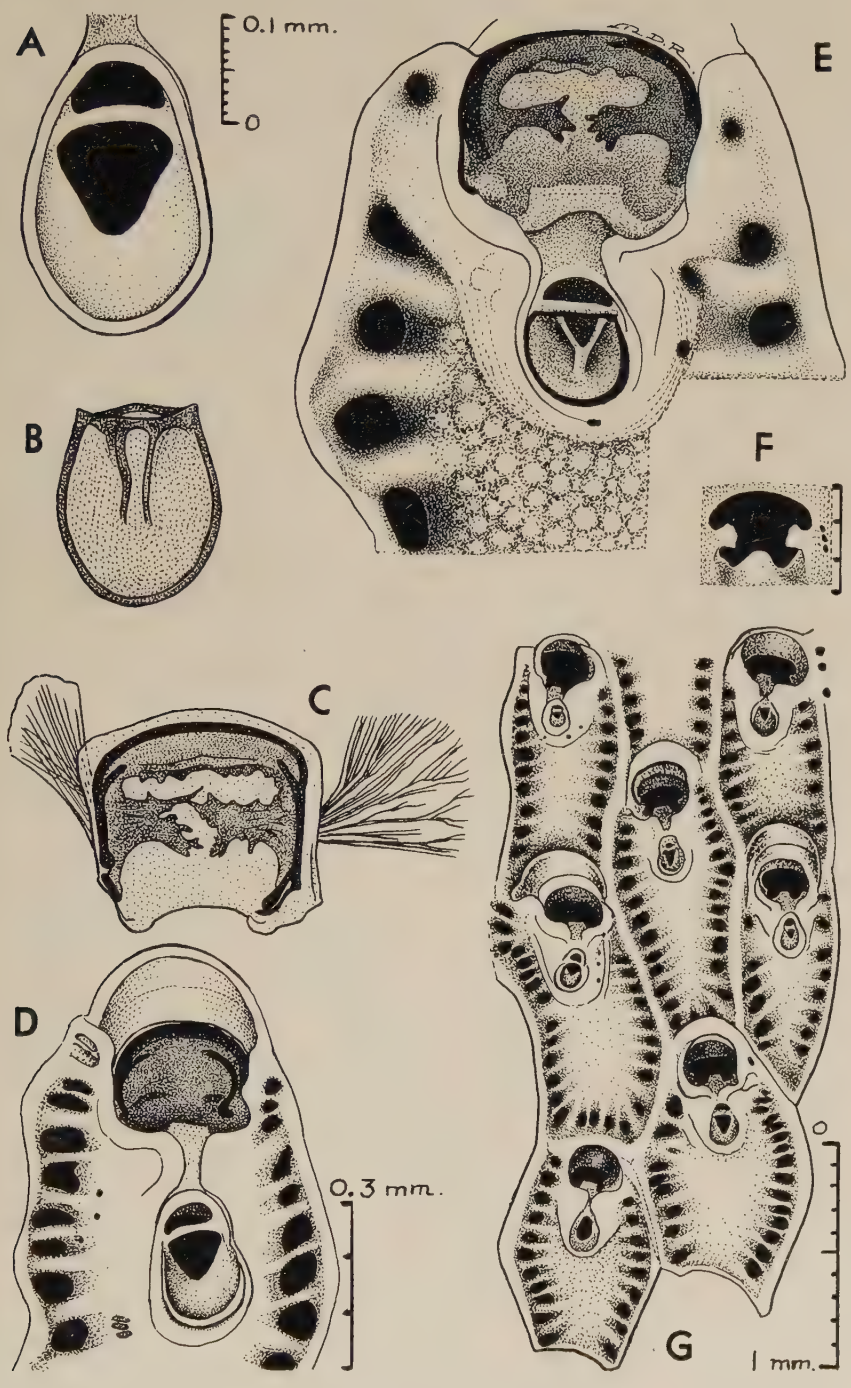

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Plate 35

Smittoidea reticulata (Johnston) (?)

Figure A: Young zoid with incomplete avicularial chamber and unformed peristome. Drawn to the 0.2 mm. scale below.

Figure B: Primary orifice and partly formed peristome enclosing the broken incomplete oral avicularium. Cardelles do not show in this zoid because they have been torn away with the peristomial lining (cf. figure C). Same scale as figure A.

Figure C: A mere shell of distal end of zooecium. The areolar pores, back wall, peristomial lining and two cardelles, which arise from the peristomial lining, are present. Same scale as figure A.

Figure D: A damaged zooecium. Above the orifice are proximal and side walls of the next distal zoid. Same scale as figure A.

Figure E: Damaged shell of a zooecium and orifice of another incomplete one (the same as pictured in figure A). Upper zoid has cardelles and distal peristomial lining. Drawn to the 0.4 mm. scale at right.

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